VAM I/O units

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User manual

Schneider Electric

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1 This document

1.1 Legal notice

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1.2 Safety information

⚠ DANGER

- Failure to follow these instructions will result in death or serious injury

⚠ WARNING

- Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions.
- Turn off all power supplying this equipment before starting the installation work.
- Ensure the protective grounding is connected.
- Before performing visual inspections, commissioning, or maintenance on this equipment, disconnect all sources of electric power.

- Assume that all circuits are live until they have been completely de-energised, tested and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Beware of potential hazards, wear personal protective equipment, carefully inspect the work area for tools and objects that may have been used during commissioning or maintenance.
- Neglecting fundamental installation requirements can lead to personal injury as well as damage to electrical equipment or other property.
- Handling this equipment requires relevant expertise in the field of protection of electrical networks. Only competent people who have this expertise are allowed to configure and set up this equipment.

⚠CAUTION

- Before performing dielectric (Hi-Pot) testing on any equipment in which the IED is installed, disconnect all input and output wires to the IED. High voltage testing can damage electronic components contained in the unit.

NOTICE

- Always use a properly rated voltage sensing device to confirm that all power is off.
- The successful operation of this equipment depends upon proper handling, installation, and operation.

1.3 Related documents

Table 1.1: Related documents

Document	Identification*)
VAMP Mounting and Commissioning Instructions	VARC_MC_xxxx
VAMP Arc I/O units user manual	VIO_EN_M_xxxx
VAMP Arc Flash Protection Testing Manual	VARCTEST_EN_M_xxx
VAMPSET Setting and Configuration Tool User Manual	VVAMPSET_EN_M_xxxx

*) *xxxx = revision number*

NOTICE Download the latest documents and software at www.vamp.fi.

1.4 Abbreviations and symbols

Table 1.2: Symbols

Symbol	Description
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Addresses practices not related to personal injury.

Table 1.3: Abbreviations

ANSI	American National Standards Institute. A standardization organisation.
CB	Circuit breaker
CBFP	Circuit breaker failure protection
Dead band	See hysteresis.
DI	Digital input
DO	Digital output, output relay
DSR	Data set ready. An RS232 signal. Input in front panel port of VAMP relays to disable rear panel local port.
DST	Daylight saving time. Adjusting the official local time forward by one hour for summer time.
DTR	Data terminal ready. An RS232 signal. Output and always true (+8 Vdc) in front panel port of VAMP relays.
FFT	Fast Fourier transform. Algorithm to convert time domain signals to frequency domain or to phasors.
Hysteresis	I.e. dead band. Used to avoid oscillation when comparing two near by values.
IEC	International Electrotechnical Commission. An international standardization organisation.
IEEE	Institute of Electrical and Electronics Engineers
IEC-101	Abbreviation for communication protocol defined in standard IEC 60870-5-101
IEC-103	Abbreviation for communication protocol defined in standard IEC 60870-5-103
LAN	Local area network. Ethernet based network for computers and relays.
Latching	Output relays and indication LEDs can be latched, which means that they are not released when the control signal is releasing. Releasing of lathed devices is done with a separate action.
NTP	Network time protocol for LAN and WWW
PT	See VT
pu	Per unit. Depending of the context the per unit refers to any nominal value. For example for overcurrent setting 1 pu = 1xI_{mode}.
SNTP	Simple Network Time Protocol for LAN and WWW
TCS	Trip circuit supervision
THD	Total harmonic distortion

U_{0sec}	Voltage at input U_c at zero ohm earth fault. (Used in voltage measurement mode “2LL+Uo”)
U_a	Voltage input for U_{12} or U_{L1} depending of the voltage measurement mode
U_b	Voltage input for U_{23} or U_{L2} depending of the voltage measurement mode
U_c	Voltage input for U_{31} or U_0 depending of the voltage measurement mode
U_n	Nominal voltage. Rating of VT primary or secondary
UTC	Coordinated Universal Time (used to be called GMT = Greenwich Mean Time)
VT	Voltage transformer i.e. potential transformer PT
VT_{pri}	Nominal primary value of voltage transformer
VT_{sec}	Nominal secondary value of voltage transformer
WWW	World wide web (internet)

2 Introduction

This User's Manual contains a functional description of the VAM I/O units and technical data.

2.1 Purpose

The main purpose of the VAM I/O units is to detect arc light or short circuit current and deliver this information (zone information) to the arc protection central unit and the other VAM I/O units. Additionally VAM I/O units can be used for tripping appropriate circuit breakers.

2.2 Main properties

Arc flash protection system is a modular system consisting of a central unit, I/O units and arc sensors.

Due to its modularity, the system is suitable for a range of arc protection applications, from simple systems with one central unit and one I/O unit to more complex solutions comprising several central units used for selective arc protection.

The I/O unit **VAM 10L / VAM 10LD, VAM 12L / VAM 12LD** serves as link between the system's point sensors and the central unit. Each I/O unit has connections for ten arc sensors, one portable pin sensor and one trip output.

The I/O unit **VAM 3L/VAM3LX** serves as link between the system's fibre sensors and the central unit. Each I/O unit has connections for three arc sensors, one pin sensor and one trip output.

The I/O unit **VAM 4C / VAM 4CD** serves as link between the system's current inputs and the central unit. Each I/O unit has connections for three current transformers and one trip output.

The arc sensor **VA 1 DA** is activated by strong light. The sensor transforms the light information into the current signal, which is forwarded through the I/O unit to the central unit. The arc sensor **VA 1 EH** also operates on the same principle.

The pin sensor **VA 1 DP** has the same functions as an arc sensor but can be temporarily connected to an I/O unit. The sensor can be fixed to the breast pocket of a technician to improve safety when working with live switchgear.

The door mounted VAM I/O units with the letter D in the type designations VAM 10LD, VAM 12LD and VAM 4CD are door mounted versions for the corresponding VAM 10L, VAM 12 L and VAM 4C units. The functionality is exactly the same.

3 User interface

Usually, there is no need to touch the front panel during normal operation, since all the necessary information can be read from the central unit display. However, after a new installation or a system expand you will need to program certain functions (zone/address, trip output) in the I/O unit.

NOTICE

If you unfasten the terminal blocks during installation, remember to tighten the fixing screws after installation! Also tighten the screws even if you did not unfasten the blocks.

3.1 VAM 3L

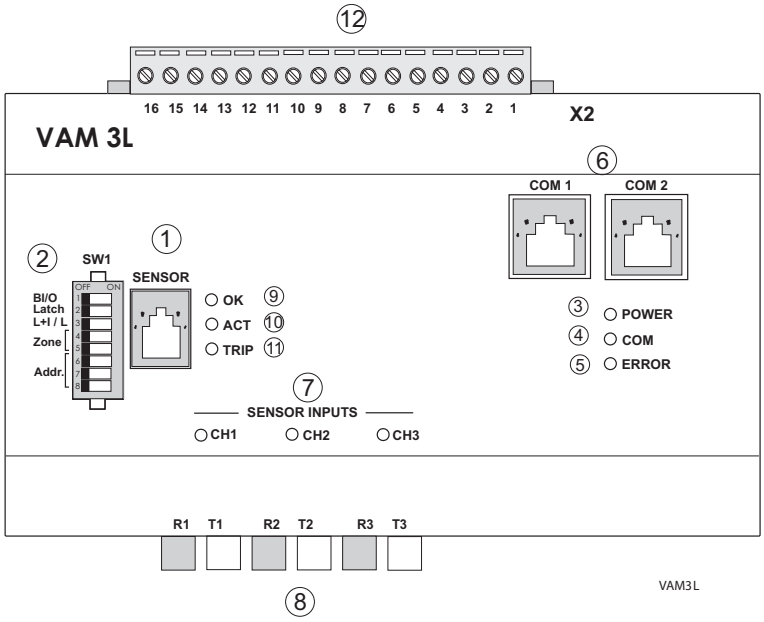


Figure 3.1: Arc fibre sensor I/O unit VAM 3L front panel

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central units and I/O units are communicating.
5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation

8. Terminals for three fibre sensors
9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal

3.2 VAM 3LX

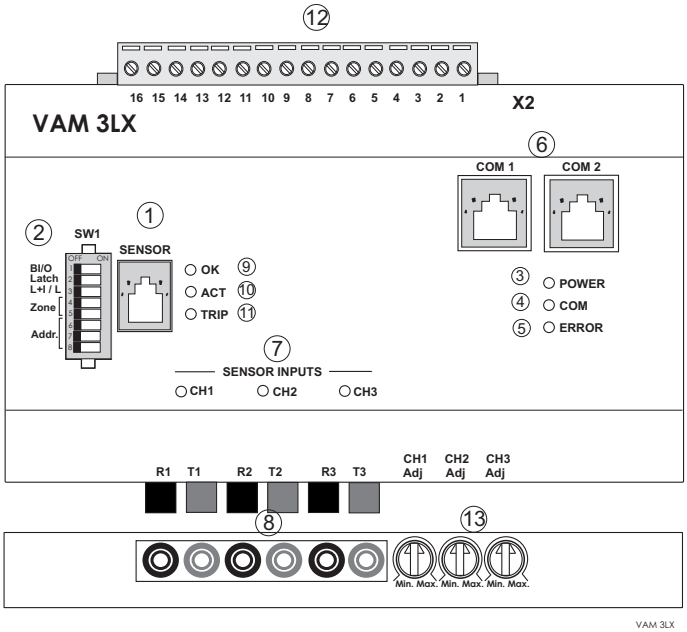


Figure 3.2: Arc fibre sensor I/O unit VAM 3LX front panel

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central units and I/O units are communicating.
5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation
8. Terminals for three fibre sensors
9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal
13. Sensitivity adjustments for each fibre sensor channels

3.3 VAM 10L

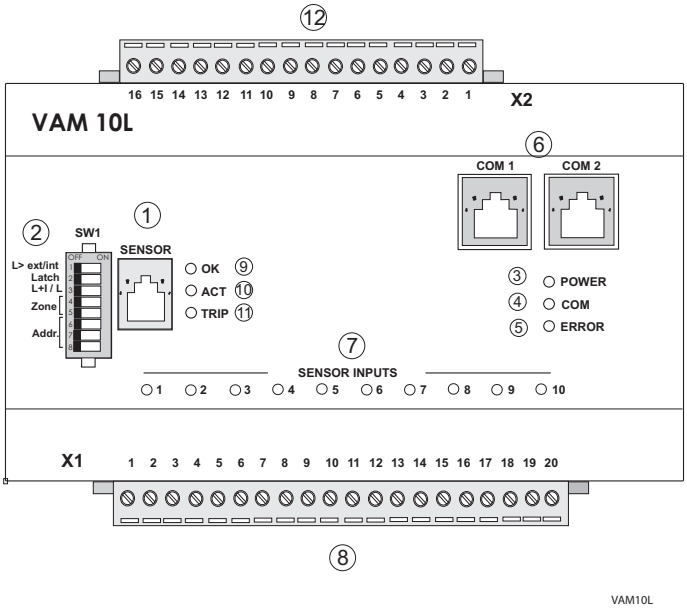


Figure 3.3: Arc sensor I/O unit VAM 10L front panel

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central unit and I/O units are communicating.
5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation
8. Terminal block for ten arc sensors
9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal

3.4 VAM 10LD

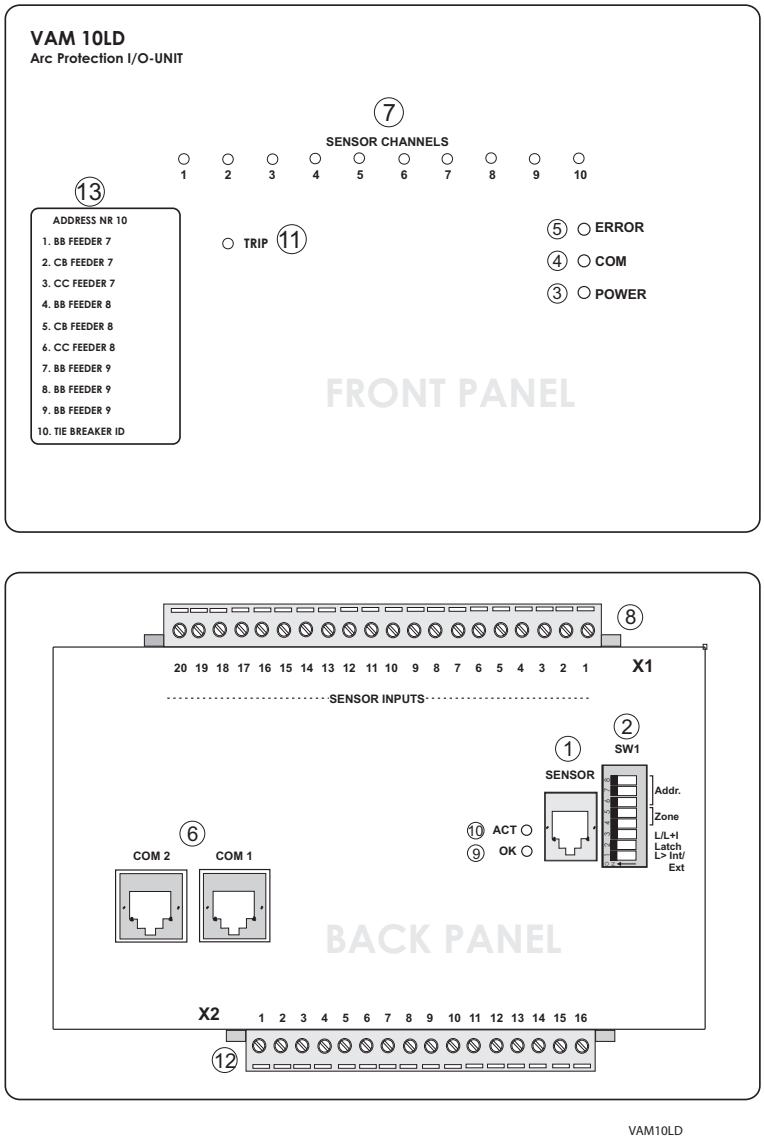


Figure 3.4: Arc sensor I/O unit VAMP 10LD front and back panels

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central unit and I/O units are communicating.
5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation
8. Terminal block for ten arc sensors

9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal
13. Text pocket for sensor specific labels.

3.5 VAM 12L

VAM 12L is primary design for selective feeder trip applications. The unit comprises 3 electromechanical trip normally open contacts and one trip alarm change over contact.

The unit has 10 Arc sensor inputs. Tree sensors (of the ten) inputs are dedicated, and are controlling their own trip relay. The unit is ideal for selective trip of cable compartment in case of an ARC fault. VAM 12L can selectively handle 3 feeders. The rest of the sensors can then supervise the busbar and breaker compartments and will operate in the zone selected by the unit address switches.

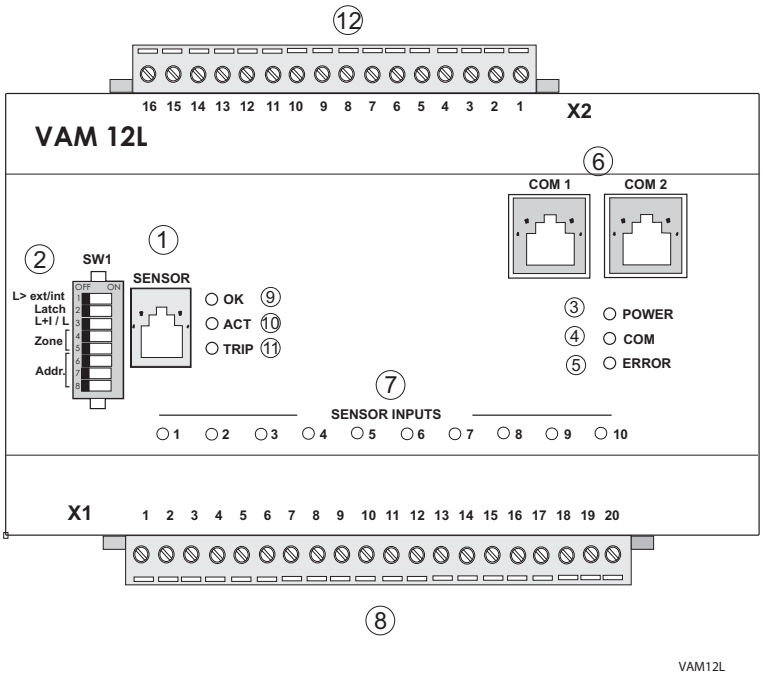


Figure 3.5: Arc sensor I/O unit 12L

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central unit and I/O units are communicating.

5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation
8. Terminal block for ten arc sensors
9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relays activated
12. Terminal block for output relay

3.6 VAM 12LD

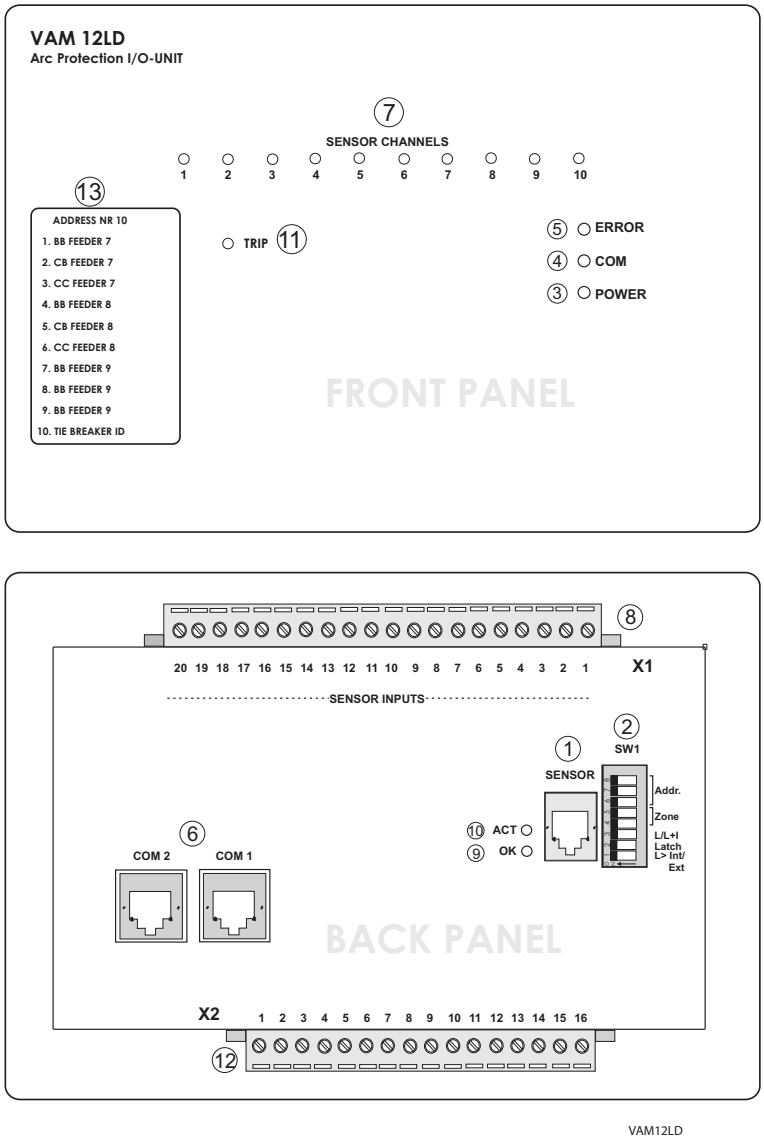


Figure 3.6: Arc sensor I/O unit VAM 12LD front and back panels

1. Connection for portable arc sensor (VA 1 DP)
2. Programming switches
3. POWER indicator light, indicates that the supply voltages of each component are in order.
4. COM indicator light, lit when the central unit and I/O units are communicating.
5. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty arc sensor or changes in the amount of sensors.
6. Connector sockets for the VX001 modular cables
7. LED lights indicating sensor activation
8. Terminal block for ten arc sensors

9. Portable arc sensor VA 1 DP connected and operational
10. Portable arc sensor activated
11. I/O unit trip relays activated
12. Terminal block for output relays
13. Text pocket for sensor specific labels.

3.7 VAM 4C

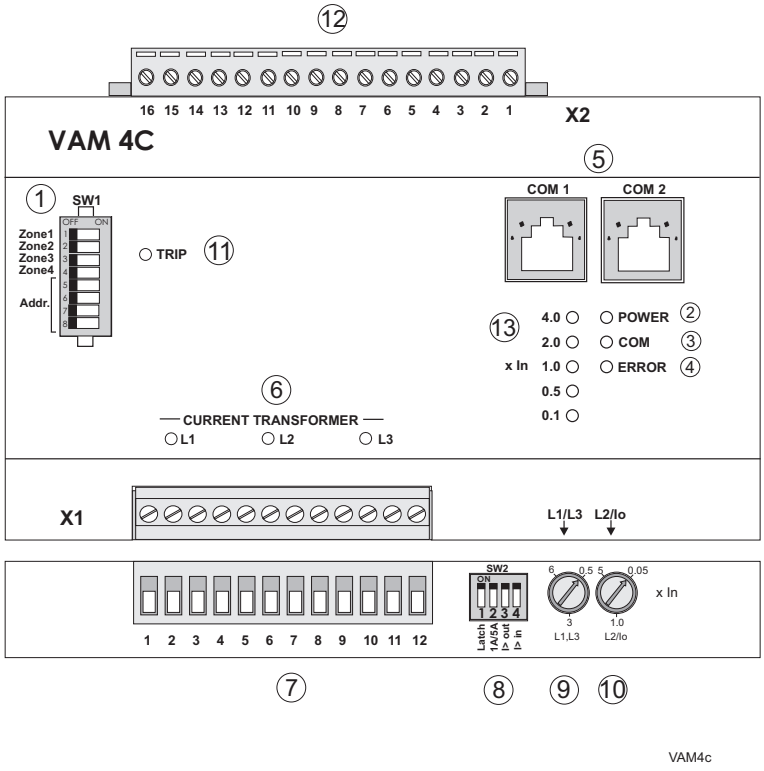


Figure 3.7: Current I/O unit VAM 4C front panel

1. Programming switches
2. POWER indicator light, indicates the supply voltages of each component are in order.
3. COM indicator light, lit when the central units and I/O units are communicating.
4. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty current transformer or phase current unbalance.
5. Connector sockets for the VX001 modular cables
6. LED lights indicating that I> stage has started
7. Terminals for three current transformers
8. Current transformer programming switches
9. Overcurrent setting knob (I_{L1}, I_{L3}), setting range 0.5…6xI_N
10. Overcurrent setting knob (I_{L1}, I_0), setting range 0.05…5xI_N
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal
13. Indicator leds for current setting

3.8 VAM 4CD

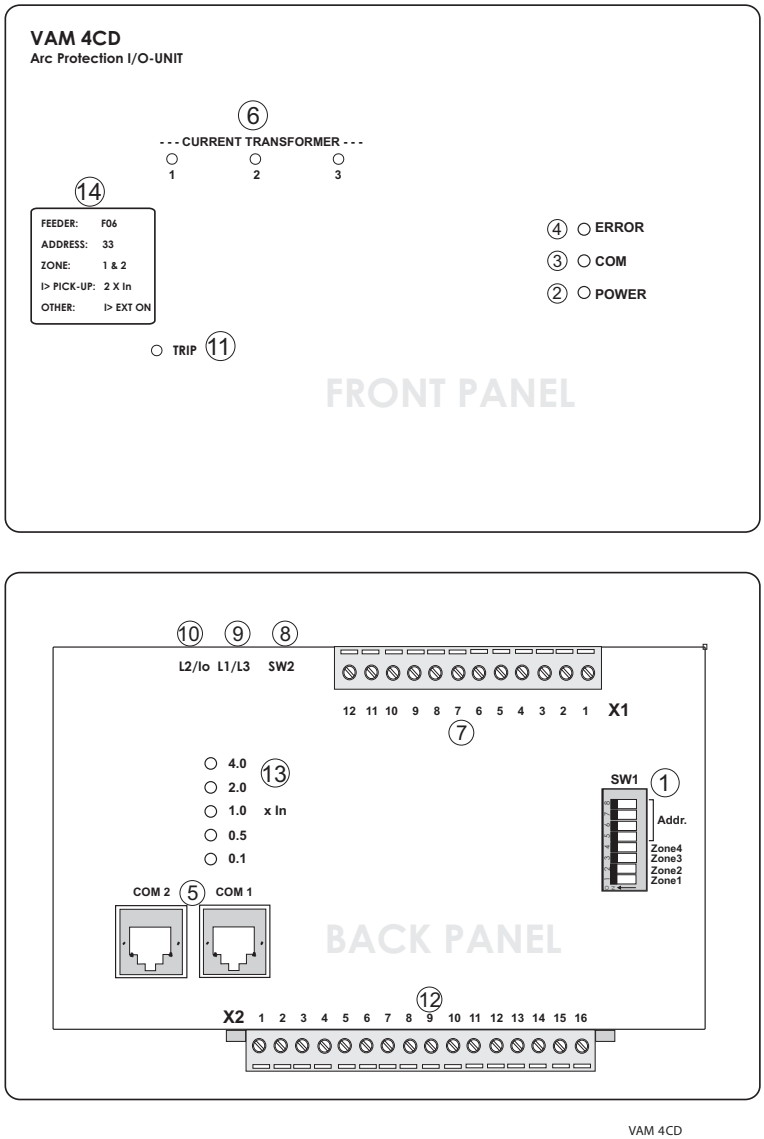


Figure 3.8: Current I/O unit VAM 4CD front and back panel

1. Programming switches
2. POWER indicator light, indicates the supply voltages of each component are in order.
3. COM indicator light, lit when the central units and I/O units are communicating.
4. ERROR indicator light, indicates an internal fault detected by the component's self-diagnostics. Such faults include faulty current transformer or phase current unbalance.
5. Connector sockets for the VX001 modular cables
6. LED lights indicating that I> stage has started
7. Terminals for three current transformers
8. Current transformer programming switches

9. Overcurrent setting knob (I_{L1}, I_{L3}), setting range 0.5…6xI_N
10. Overcurrent setting knob (I_{L1}, I_0), setting range 0.05…5xI_N
11. I/O unit trip relay activated
12. Terminal block for external communication and BI/O channels and trip signal
13. Indicator leds for current setting
14. Text pocket

3.9 VAMP 4R

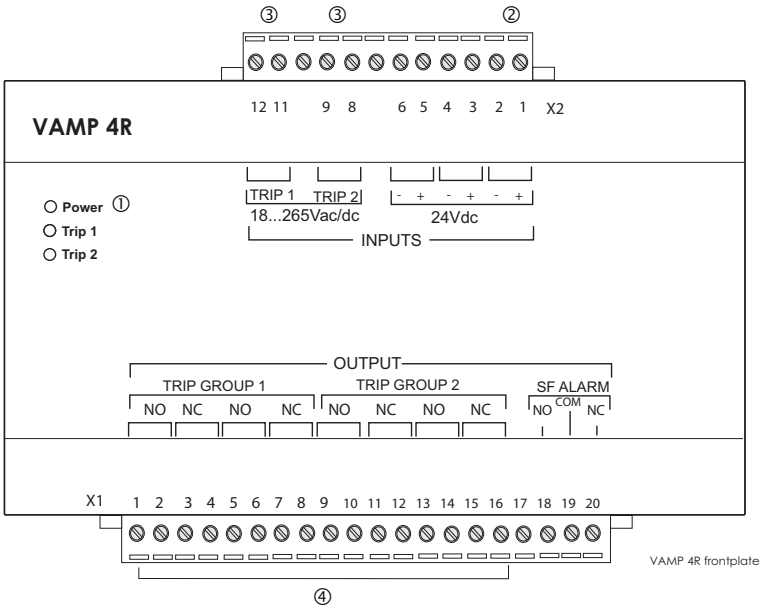

③ ③ ②
12 11 9 8 6 5 4 3 2 1 X2
VAMP 4R
Power ①
Trip 1
Trip 2
TRIP 1 TRIP 2
18...265Vac/dc
- + - + - +
24Vdc
INPUTS
OUTPUT
TRIP GROUP 1
TRIP GROUP 2
SF ALARM
NO NC NO NC NO NC NO NC NO COM NC
X1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
④
VAMP 4R frontplate

Figure 3.9: Multiplying relay VAMP 4R

1. POWER LED, indicates that the external operating voltage of +24 Vdc is connected.
2. Terminals for external operating voltage (+24 Vdc). Can be supplied by central units or I/O units.
3. Terminals for incoming trip signal (e.g. 24 Vdc from VAM I/O unit binary output, 2 groups). Control voltage range is 18 … 265 Vad/dc.
4. Terminals for outgoing trip signals (8 potential-free contacts, 4 normally open, 4 normally closed).

4 Programming switches

Before system implementation, check the positions of the programming switches in accordance with the following basic principles:

- Each I/O unit connected to the communication bus has its own address (each I/O unit have an unique address).
- Set the programming switches before connecting the supply voltage.
- If you have to change the switch positions once the supply voltage has been connected, disconnect the supply voltage to the unit in question for the duration of the programming and re-configure the system.
- If position of the switch is changed, re-install the system again in the central unit.

4.1 Switches for arc sensor I/O units

The programming switches of the I/O units are used to determine the unit address and trip relay function.

The system accommodates up to 16 I/O units. Eight addresses are reserved for each protection zone:

- **Zone 1** addresses 0…7
- **Zone 2** addresses 8…15
- **Zone 3** addresses 16…23
- **Zone 4** addresses 24…31

The programming switches have different weight factors. To create an address for the I/O unit, turn switches with different values to the ON position and calculate the sum of their weight factors. The following table shows the weight factors of each programming switch.

Table 4.1: Programming switch weight factors, *) VAM 3L and VAM 3LX, VAM 10L / VAM 10LD, VAM 12L / VAM 12LD only

Switch No.	Weight factor
8	1
7	2
6	4
5	8
4 *)	16

NOTICE Note the position of the VAM 12LD, VAM 10LD and VAM 4CD dip switches.

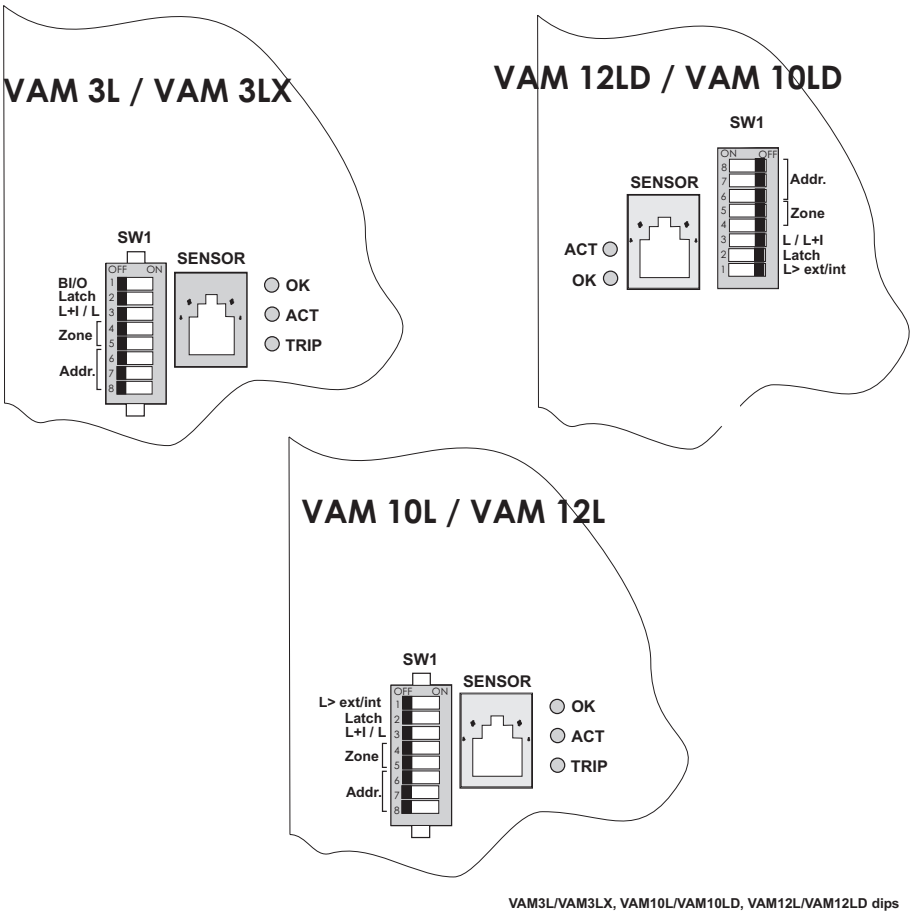


Figure 4.1: Programming switches for VAM 3L, VAM 3LX, VAM 10L, VAM 10LD, VAM 12L and VAM 12LD

VAM 3L / VAM 3LX, VAM 10L / VAM 10LD

Switch 1 determines which light activation activates the arc stage. When the switch position is ON, the arc stage only activates on the light information provided by the unit's own sensors. In OFF position the arc stage activates on the light information received from any unit in the same protection zone.

Switch 2 determines the trip relay latch. When the switch is in ON position the trip relay remains engaged after the arc trip until the fault is acknowledged at the central unit’s panel. In the OFF position the trip relay follows the arc fault.

Switch 3 determines the arc trip criteria. When the switch is in ON position the trip is based on light information only; in OFF position both fault currents exceeding the current limit and light information are required.

VAM 12L / VAM 12LD

When the L>ext/int DIP switch is in “L>int” position, the output relays are only activated by dedicated sensors.

SENSOR 1 activates T1.

SENSOR 2 activates T2.

SENSOR 3 activates T3.

SENSORS 4 to 10 are normally sending light information to system according to zone setting.

If the switch is in “L>ext” position, all output relays are also controlled by the selected zone information. This activation source can be any sensor channel 4 to 10 or from an external I/O unit configured to the same zone.

4.2 Switches for current I/O units

The address range for current I/O units is (32),33…46. Do not use address 32, because in this case the current I/O unit operates in CENTRAL UNIT mode and the actual central unit must be set to SUB-UNIT mode. To determine the address of a current I/O unit, add the sum of the weight factors to 32 (for example, programming switch values total 7, address of the current I/O unit 32 + 7 = 39).

NOTICE Do not use 32 as the unit address if system have central unit.

Other programming switches have different functions in different units, as described below.

VAM 4C / VAM 4CD

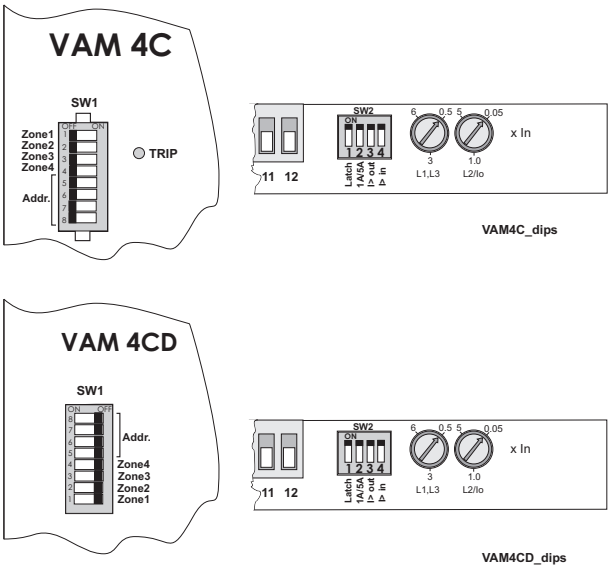


Figure 4.2: Programming switches of VAM 4C / VAM 4CD

Table 4.2: VAM4C dipswitches weight factors

SW NO:	Weight factor
8	1
7	2
6	4
5	8

SW1 switch settings

Switch	Definition	Description
1	Zone 1	System operating zone 1 (light information)
2	Zone 2	System operating zone 2 (light information)
3	Zone 3	System operating zone 3 (light information)
4	Zone 4	System operating zone 4 (light information)
5	Addr	Address weighting coefficient 8
6	Addr	Address weighting coefficient 4
7	Addr	Address weighting coefficient 2
8	Addr	Address weighting coefficient 1

SW2 switch settings

Switch	Definition	Description
1	Latch	Position ”0” (switch down): trip relay is only operational while the protection is activated Position ”1” (switch up): trip relay changes to latching status after trip
2	1A / 5A *	Position ”0” (switch down): rated secondary current of the current transformer is 1 A Position ”1” (switch up): rated secondary current of the current transformer is 5 A
3	I> out	Position ”0” (switch down): unit does not transmit the current criteria to other units Position ”1” (switch up): unit transmits the current criteria to other units
4	I> in	Position ”0” (switch down): unit does not receive the current criteria from other units Position ”1” (switch up): unit receives the current criteria from other units

*) As in CT

5 Adjusting the overcurrent setting

The principles for changing the current setting in VAM 4C units are the same as for the central unit. You can see the estimated current setting from the led bar on the right side of the unit.

The most accurate way of setting the current limit for the unit is as follows:

- Turn the potentiometer to the maximum value.
- Feed a test current corresponding to the required setting using a testing device.
- Lower the setting until the current activation indicator led of the I/O unit and the I>ext indicator led in the central unit are lit.

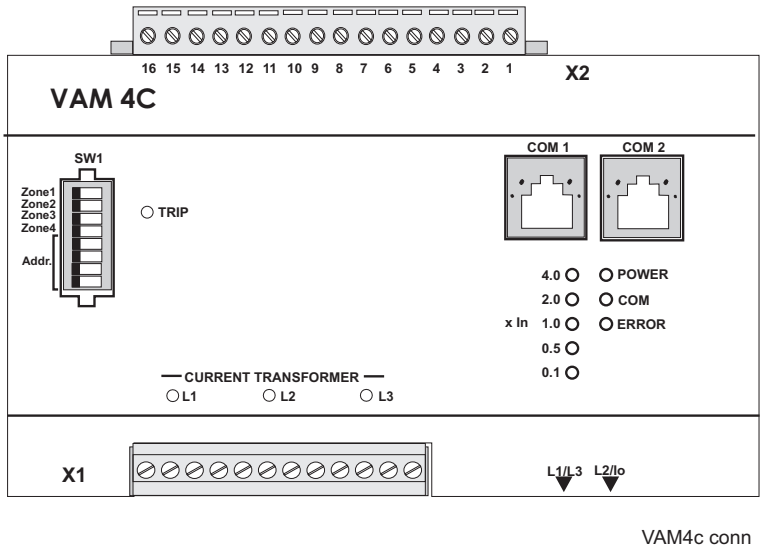


Figure 5.1: Adjusting the current setting in VAM 4C

6 BI/BO connection

Each I/O unit also has a BI/O bus. The light I/O units (VAM 3L / VAM 3LX, VAM 10L / VAM 10LD, VAM 12L / VAM 12LD) can transmit trip signal to the central unit or current I/O unit. The current I/O unit (VAM 4C / VAM 4CD) can receive the light information and send the current information either to other I/O units or the multiplying relay.

NOTICE The DI/DO on the VAM units are fast BI/BO signals.

The following DI and DO connections are included in the standard delivery of VAM 3L / VAM 3LX and VAM 10L units:

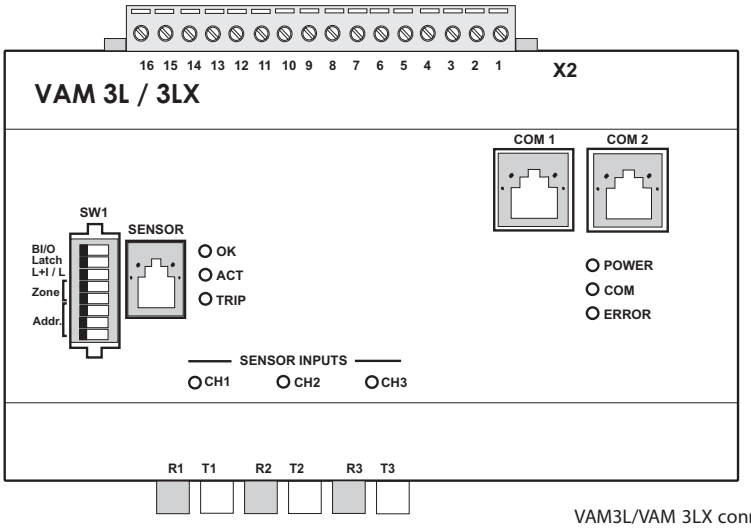
DI	X2-8	Zone shift 1(2, 2(1, 3(4, 4(3
GND	X2-7	
Trip out	X2-10	Trip signal, 24 V dc
GND	X2-9	Trip signal earth

The following DI and DO connections are included in the standard delivery of VAM 4C units:

L>in	X2-8	Light input, 24-48 V dc
GND	X2-7	Light input earth
Trip out	X2-10	Trip signal
GND	GND	Trip signal earth

7 Connection examples

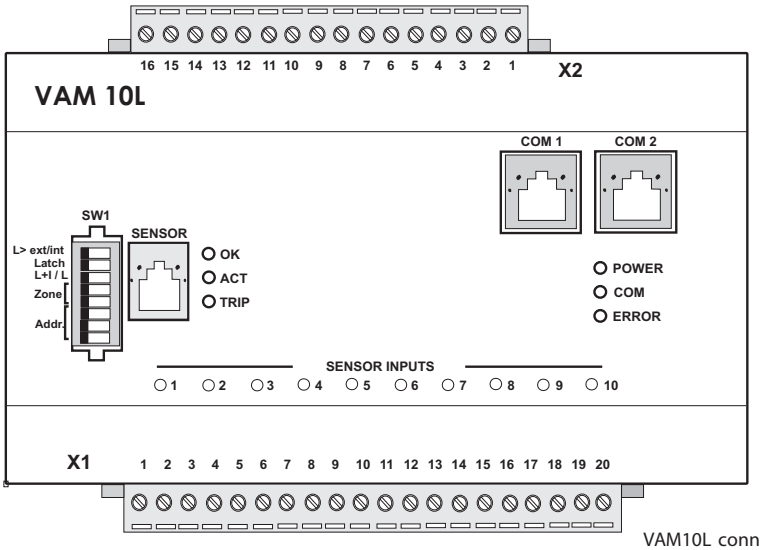
7.1 VAM 3L / VAM 3LX interfaces



VAM3L/VAM 3LX conn

X1-R1:	Fiber receiver connection	Channel 1	
X1-T1:	Fiber transmitter connection		
X1-R2:	Fiber receiver connection	Channel 2	
X1-T2:	Fiber transmitter connection		
X1-R3:	Fiber receiver connection	Channel 3	
X1-T3:	Fiber transmitter connection		
X2-1:	+24V supply from master unit or external power supply		= COM1, COM2
X2-2:	GND		
X2-3:	CAN-L	Zone information (L>, I>)	
X2-4:	CAN-H		
X2-5:	Serial B	master slave com	
X2-6:	Serial A		
X2-7:	DI GND	Zone change	
X2-8	DI (24-48Vdc)	(1 -> 2; 2 -> 1; 3 -> 4; 4 -> 3)	
X2-9:	DO GND	Trip signal (DI&DO)	
X2-10:	DO +24Vdc		
X2-11:	+ Temp sensor	Not in use	
X2-12:	- Temp sensor		
X2-13:			
X2-14:			
X2-15:	Trip relay (NO)		
X2-16:	Trip relay (NO)		

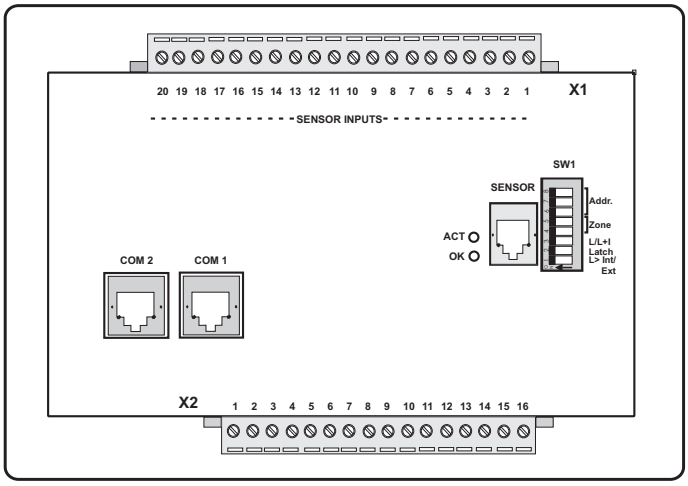
7.2 VAM 10L interfaces



VAM10L conn

X1-1,2:	arc sensor channel 1		
X1-3,4:	arc sensor channel 2		
X1-5,6:	arc sensor channel 3		
X1-7,8:	arc sensor channel 4		
X1-9,10:	arc sensor channel 5		
X1-11,12:	arc sensor channel 6		
X1-13,14:	arc sensor channel 7		
X1-15,16:	arc sensor channel 8		
X1-17,18:	arc sensor channel 9		
X1-19,20:	arc sensor channel 10		
X2-1:	+24V supply from masterunit or external power supply		=COM1, COM2
X2-2:	GND		
X2-3:	CAN-L	Zone information (L>, I>)	
X2-4:	CAN-H		
X2-5:	Serial B	Master slave com	
X2-6:	Serial A		
X2-7:	DI GND	Zone change	
X2-8:	DI (24-48Vdc)	(1 -> 2; 2 ->1; 3 -> 4; 4 -> 3)	
X2-9:	DO GND	Trip signal	
X2-10:	DO +24Vdc		
X2-11:	+ Temp sensor	Not in use	
X2-12:	- Temp sensor		
X2-13:			
X2-14:			
X2-15:	Trip relay (NO)		
X2-16:	Trip relay (NO)		

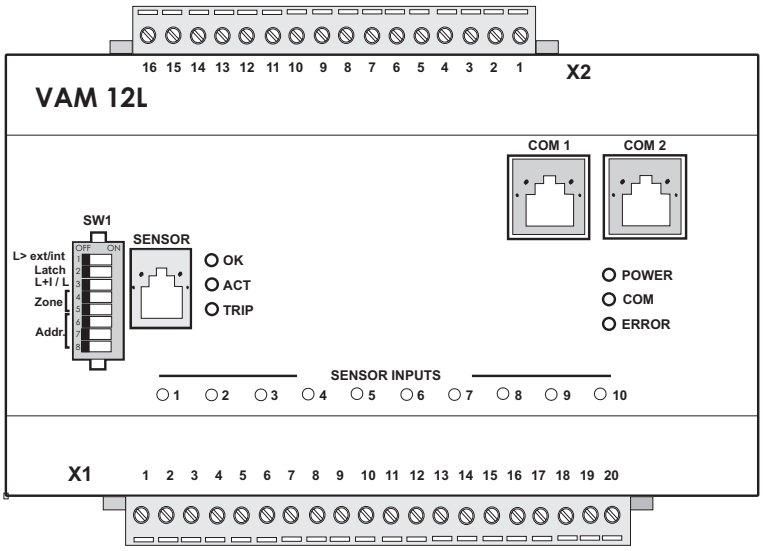
7.3 VAM 10LD interfaces



VAM10LD conn

X1-1,2:	arc sensor channel 1		
X1-3,4:	arc sensor channel 2		
X1-5,6:	arc sensor channel 3		
X1-7,8:	arc sensor channel 4		
X1-9,10:	arc sensor channel 5		
X1-11,12:	arc sensor channel 6		
X1-13,14:	arc sensor channel 7		
X1-15,16:	arc sensor channel 8		
X1-17,18:	arc sensor channel 9		
X1-19,20:	arc sensor channel 10		
X2-1:	+24V supply from masterunit or external power supply		=COM1, COM2
X2-2:	GND		
X2-3:	CAN-L	Zone information (L>, I>)	
X2-4:	CAN-H		
X2-5:	Serial B	Master slave com	
X2-6:	Serial A		
X2-7:	DI GND	Zone change	
X2-8:	DI (24-48Vdc)	(1 -> 2; 2 ->1; 3 -> 4; 4 -> 3)	
X2-9:	DO GND	Trip signal	
X2-10:	DO +24Vdc		
X2-11:	+ Temp sensor	Not in use	
X2-12:	- Temp sensor		
X2-13:			
X2-14:			
X2-15:	Trip relay (NO)		
X2-16:	Trip relay (NO)		

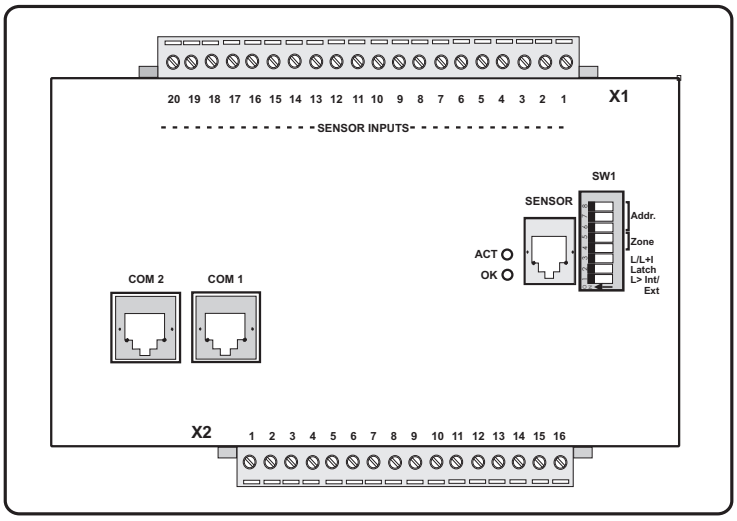
7.4 VAM 12L interfaces



VAM12L conn

X1-1,2:	arc sensor channel 1		
X1-3,4:	arc sensor channel 2		
X1-5,6:	arc sensor channel 3		
X1-7,8:	arc sensor channel 4		
X1-9,10:	arc sensor channel 5		
X1-11,12:	arc sensor channel 6		
X1-13,14:	arc sensor channel 7		
X1-15,16:	arc sensor channel 8		
X1-17,18:	arc sensor channel 9		
X1-19,20:	arc sensor channel 10		
X2-1:	+24v supply from masterunit or external power supply		
X2-2:	GND		
X2-3:			
X2-4:	COM	Alarm	
X2-5:	NO		
X2-6:	NC		
X2-7:			
X2-8:	Trip relay 3 (NO)		
X2-9:	Trip relay 3 (NO)		
X2-10:			
X2-11:	Trip relay 2 (NO)		
X2-12:	Trip relay 2 (NO)		
X2-13:			
X2-14:			
X2-15:	Trip relay 1 (NO)		
X2-16:	Trip relay 1 (NO)		

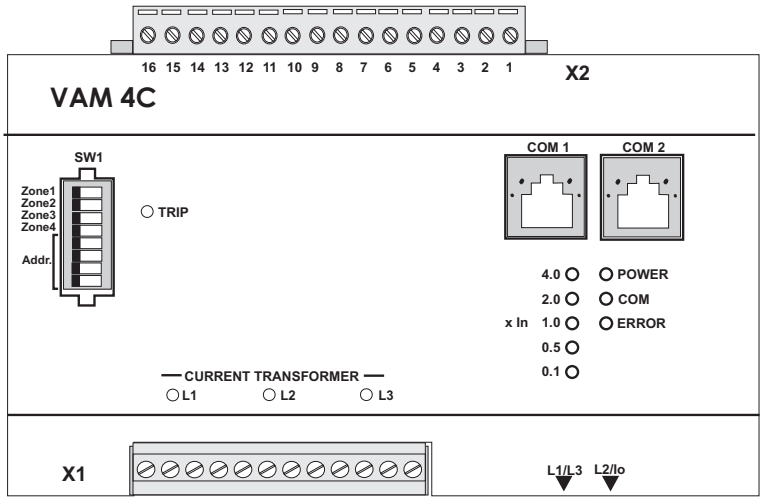
7.5 VAM 12LD



VAM12LD conn

X1-1,2:	arc sensor channel 1		
X1-3,4:	arc sensor channel 2		
X1-5,6:	arc sensor channel 3		
X1-7,8:	arc sensor channel 4		
X1-9,10:	arc sensor channel 5		
X1-11,12:	arc sensor channel 6		
X1-13,14:	arc sensor channel 7		
X1-15,16:	arc sensor channel 8		
X1-17,18:	arc sensor channel 9		
X1-19,20:	arc sensor channel 10		
X2-1:	+24v supply from masterunit or external power supply		
X2-2:	GND		
X2-3:			
X2-4:	COM	Alarm	
X2-5:	NO		
X2-6:	NC		
X2-7:			
X2-8:	Trip relay 3 (NO)		
X2-9:	Trip relay 3 (NO)		
X2-10:			
X2-11:	Trip relay 2 (NO)		
X2-12:	Trip relay 2 (NO)		
X2-13:			
X2-14:			
X2-15:	Trip relay 1 (NO)		
X2-16:	Trip relay 1 (NO)		

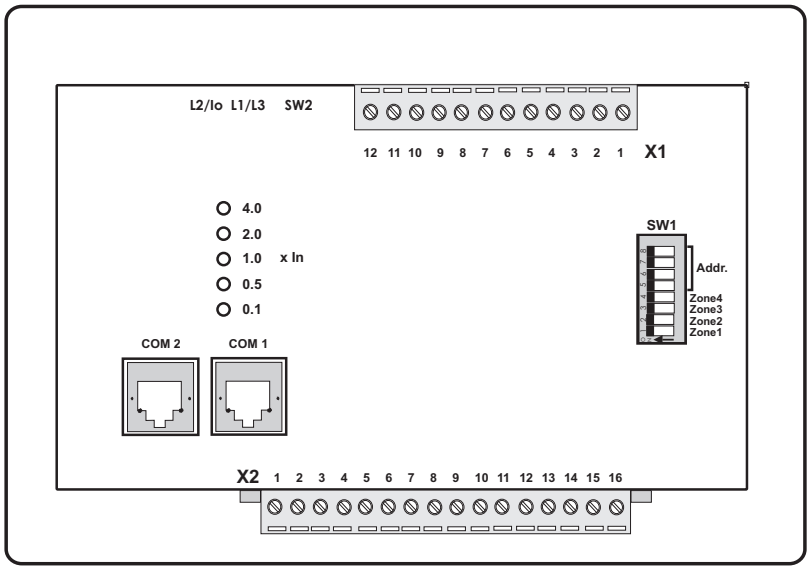
7.6 VAM 4C interfaces



VAM4c conn

X1-1,3:	Current input IL1		
X1-5,7:	Current input IL2 / Io		
X1-9,11.	Current input IL3		
X2-1:	+24V supply from master unit or external power supply		= COM1, COM2
X2-2:	GND		
X2-3:	CAN-L	Zone information (L>, I>)	
X2-4:	CAN-H		
X2-5:	Serial B	master slave com	
X2-6:	Serial A		
X2-7:	DI GND	L>	
X2-8:	DI (24-48Vdc)		
X2-9:	DO GND	TRIP	
X2-10:	DO +24Vdc		
X2-11:			
X2-12:			
X2-13:			
X2-14:			
X2-15:	Trip relay (NO)		
X2-16:	Trip relay (NO)		

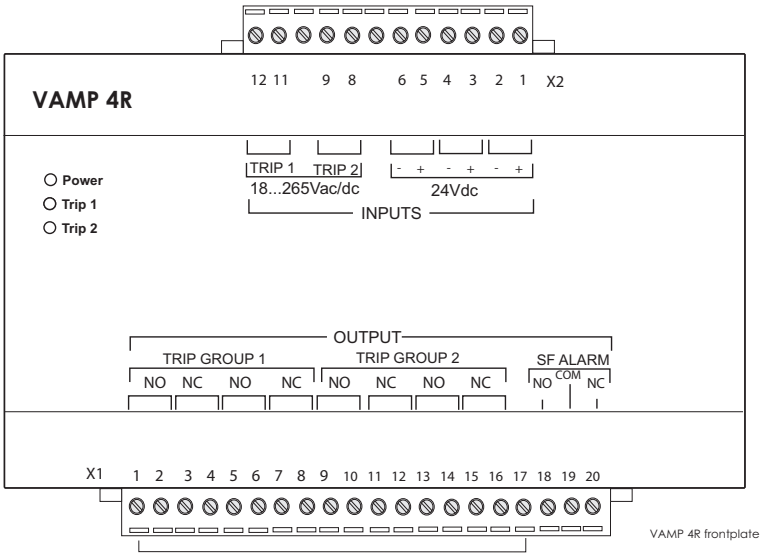
7.7 VAM 4CD interfaces



VAM4CD conn

X1-1,3:	Current input IL1		
X1-5,7:	Current input IL2 / Io		
X1-9,11.	Current input IL3		
X2-1:	+24V supply from master unit or external power supply		= COM1, COM2
X2-2:	GND		
X2-3:	CAN-L	Zone information (L>, I>)	
X2-4:	CAN-H		
X2-5:	Serial B	master slave com	
X2-6:	Serial A		
X2-7:	DI GND	L>	
X2-8:	DI (24-48Vdc)		
X2-9:	DO GND	TRIP	
X2-10:	DO +24Vdc		
X2-11:			
X2-12:			
X2-13:			
X2-14:			
X2-15:	Trip relay (NO)		
X2-16:	Trip relay (NO)		

7.8 Multiplying relay VAMP 4R


VAMP 4R
12 11 9 8 6 5 4 3 2 1 X2
TRIP 1 TRIP 2
18...265Vac/dc
24Vdc
INPUTS
Power
Trip 1
Trip 2
OUTPUT
TRIP GROUP 1
TRIP GROUP 2
SF ALARM
NO NC NO NC NO NC NO NC NO COM NC
X1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
VAMP 4R frontplate

X1-1,2:	Trip relay (NO), Trip group 1.		
X1-3,4:	Trip relay (NC), Trip group 1.		
X1-5,6:	Trip relay (NO), Trip group 1.		
X1-7,8:	Trip relay (NC), Trip group 1.		
X1-9,10:	Trip relay (NO), Trip group 2.		
X1-11,12:	Trip relay (NC), Trip group 2.		
X1-13,14:	Trip relay (NO), Trip group 2.		
X1-15,16:	Trip relay (NC), Trip group 2.		
X1-17:			
X1-18:	NO	SF Alarm relay	
X1-19:	COM		
X1-20:	NC		
X2-1:	Aux voltage supply +24Vdc		
X2-2:	GND		
X2-3:	Aux voltage supply +24Vdc		
X2-4:	GND		
X2-5:	Aux voltage supply +24Vdc		
X2-6:	GND		
X2-7:			
X2-8:	TRIP 2. Input 18...265Vac/dc	Trip group 2.	
X2-9:	TRIP 2. Input 18...265Vac/dc		
X2-10:			
X2-11:	TRIP 1. Input 18...265Vac/dc	Trip group 1.	
X2-12:	TRIP 1. Input 18...265Vac/dc		

8 Technical data

8.1 Connections

VAM 3L

Sensor connections	3 fibre loop sensors (type ARC-SLx) 1 portable arc sensor (type VA 1 DP)

VAM 3LX

Sensor connections	3 fibre loop sensors (type ARC-SLx) - sensitivity adjust range compared to 3L 0,5 (max) … 1,5 (min) 1 portable arc sensor (type VA 1 DP)

VAM 10L, VAM 10LD, VAM 12L, VAM 12LD

Sensor connections	10 arc sensors (type VA 1 DA or VA 1 EH) 1 portable arc sensor (type VA 1 DP)
Terminal: - Phoenix MVSTBW or similar	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAM 4C, VAM 4CD

Rated current L1 / L3 - current measuring zone - thermal withstand capability - power consumption	1 or 5 A (optional) 50/60Hz 0 … 6 A (0 … 6*I_N [I_N =1A]); 0 … 30 A (0 … 6* I_N [I_N =5A]) 300 A (for 1s) 100 A (for 10s) 20 A (continuous) <0.3 VA
Rated current L2 / I_0 - current measuring zone - thermal withstand capability - power consumption	1 or 5 A (optional) 50/60Hz 0 … 6 A (0 … 6*I_N [I_N =1A]); 0 … 30 A (0 … 6* I_N [I_N =5A]) 300 A (for 1s) 100 A (for 10s) 20 A (continuous) <0.3 VA
Terminal: - single or multi-strand wire	Maximum cross-section area of wire 4 mm^2 (10-12 AWG)

8.1.1 Auxiliary power supply

VAM 3L, VAM 3LX, VAM 10L, VAM 10LD, VAM 12L, VAM 12LD, VAM 4C, VAM 4CD

Rated voltage U_{AUX}	24 V dc
Power consumption	< 1 W (in normal mode) < 1.5 W (output relays activated)
Terminal: - Phoenix MVSTBW or similar (RJ 45 when supply from central unit)	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAR 4CE

Rated voltage U_{AUX}	24 V dc
Power consumption	< 0.5 W (in normal mode) < 4.5 W (output relays activated)
Terminal: - fixed terminal	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAMP 4R

Rated voltage U_{AUX}	24 V dc
Current consumption - one relay group activated - both relay groups activated	20 mA stby 80 mA 180 mA

VA 1 DA, VA 1 EH, VA 1 DP

Rated voltage U_{AUX}	12 V dc (from I/O unit)
Power consumption	< 35 mW (in normal mode) < 450 mW (activated)

8.1.2 Digital inputs (BI/O bus)

No digital inputs available in VAM 12L and VAM 12LD

VAM 3L, VAM 3LX, VAM 10L, VAM 10LD

Number of inputs	1 pcs I> in 1 arc fault trip out
Internal operating voltage	24…48 V dc (BIO in) 24 V dc (BIO out)
Load capacity (max.)	5 mA
Terminal: - Phoenix MVSTBW or similar	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAM 4C

Number of inputs	1 pcs L> in 1 pcs I> out
Internal operating voltage	24…48 V dc (BIO in) 24 V dc (BIO out)
Load capacity (max.)	5 mA
Terminal: - Phoenix MVSTBW or similar	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAMP 4R

Operating voltage	18…265 V ac/dc
Current consumption	2 mA

8.1.3 Trip contacts

VAM 3L, VAM 3LX, VAM 10L, VAM 10LD, VAM 12L, VAM 12LD, VAM 4C, VAM 4CD

Number of contacts for VAM 10L, VAM 10LD, VAM 3L, VAM 3LX, VAM 4C, VAM 4CD	1 closing contact (relay T1)
Number of contacts for VAM 12L, VAM 12LD	3 closing contacts (relay T1)
Rated voltage	250 V ac/dc
Continuous withstand capacity	5 A
Make and carry for 0.5s Make and carry for 3s	30 A 15 A
Breaking capacity, dc(L/R=40 ms)	
At 48 V dc:	1 A
At 110 V dc:	0.44 A
At 220 V dc:	0.22 A
Relay material	AgNi 90/10
Terminal: - Phoenix MVSTBW or similar	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

VAMP 4R

4N/O / 4N/C rated voltage	250V ac/dc
Continuous withstand capacity	5A
Make and carry for 0.5s Make and carry for 3s	30A 15A
N/O breaking capacity dc (L/R=40ms)	
At 48 V dc	1A
At 110 V dc	0.44A
At 220 V dc	0.22A
Contact material	AgNi 90/10
Terminal: - Phoenix MVSTBW or similar	Maximum cross-section area of wire 2.5 mm^2 (13-14 AWG)

8.2 Test and environmental conditions

8.2.1 Environmental conditions

Operating temperature range	-10 … +55°C
Transport and storage temperature range - VAM I/O units - ARC SLm, VA 1 xx sensors	-40 … +70°C -40 … +85°C
Relative air humidity	<75% (1 year, average) <90% (30 days per year, condensation not allowed)
Operation altitude	2000 m

8.2.2 Casing

VAM 3L, VAM 3LX, VAM 10L, VAM 4C, VAMP 4R

Housing class (IEC 60529)	IP21
Dimensions (WxHxD)	157x92x25 mm
Material	1mm steel plate
Weight	0.52 kg
Colour code	RAL 7032 (housing) / RAL 70035 (back plate)

VAM 10LD, VAM 12LD, VAM 4CD

Door mounted (IEC 60529)	IP64
Dimensions (WxHxD)	185x120x25 mm
Material	1mm steel plate
Weight	0.60 kg
Colour code	RAL 7032 (housing) / RAL 70035 (back plate)

VA 1 DA, VA 1 EH, VA 1 DP

Housing class (IEC 60529)	IP21
Dimensions (WxHxD)	25x55x14 mm (VA 1 DA) Φ11x62 mm (VA 1 EH) Φ40x7 mm (VA 1 DP)
Material	Plastic
Weight	0.01 kg
Cable length	6 m or 20 m (VA 1 DP 5 m)

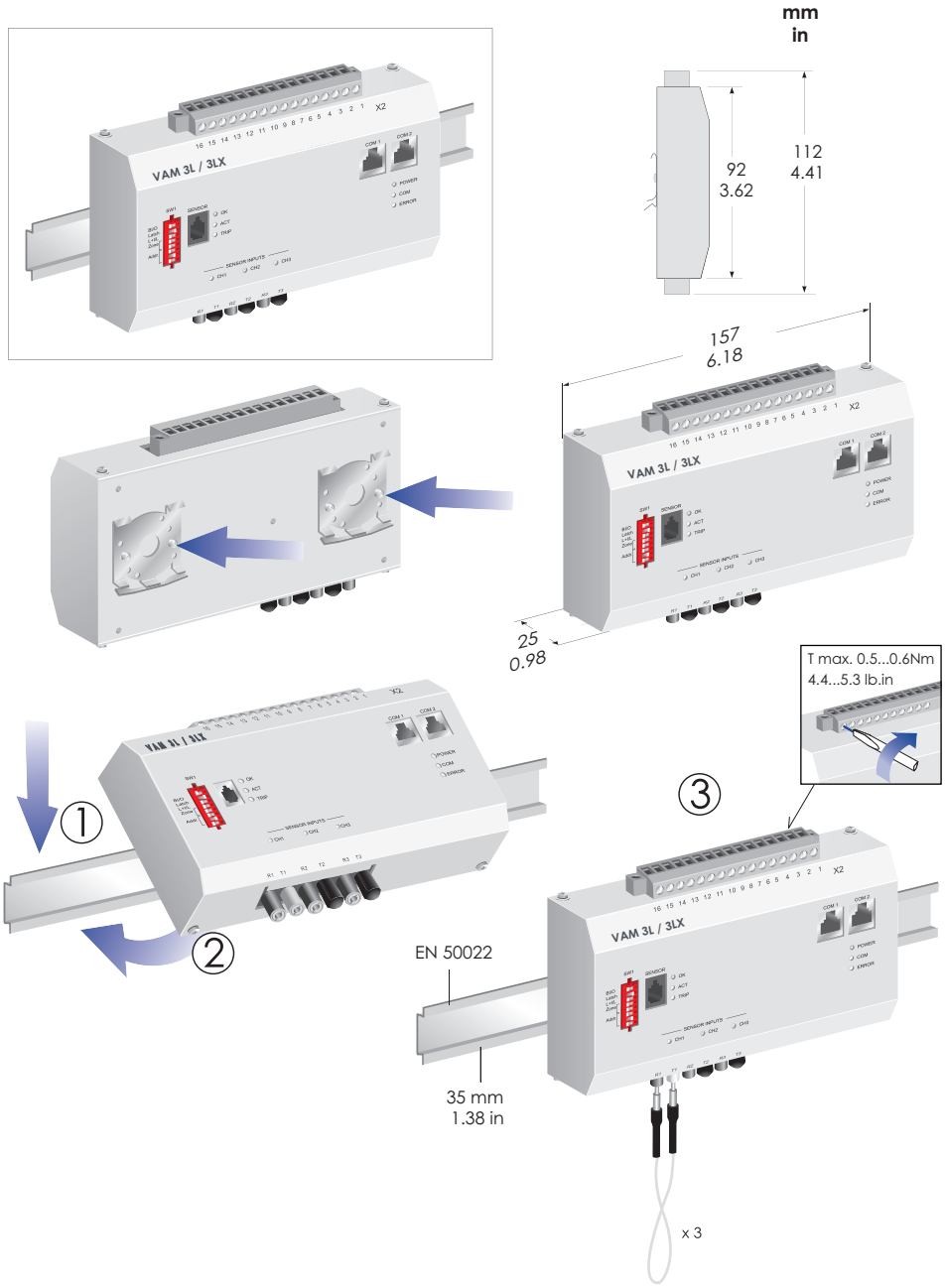
8.2.3 Package

Dimensions (WxHxD)	VAMP 4R: 157 x 92 x 25 mm VAM 10L: 157 x 92 x 25 mm VAM 3L: 157 x 92 x 25 mm VAM 3LX: 157 x 92 x 25 mm VAM 4C: 157 x 92 x 25 mm
Weight (unit, box and user instructions)	VAMP 4R: 0.62 kg VAM 10L: 0.62 kg VAM 3L: 0.62 kg VAM 3LX: 0.62 kg VAM 4C: 0.62 kg

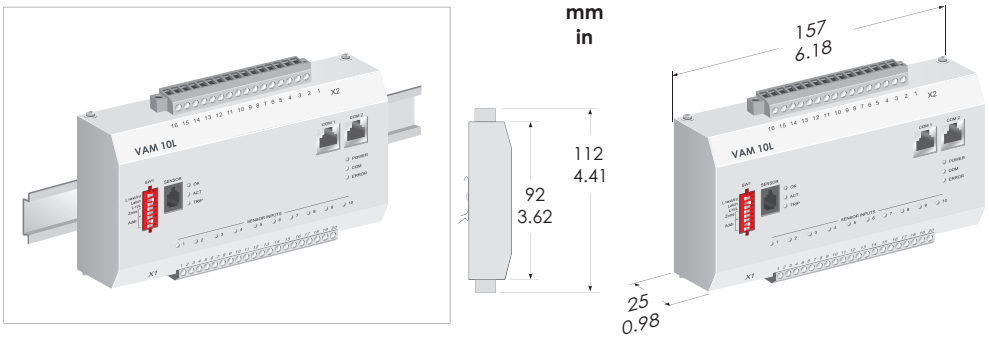
9 Construction

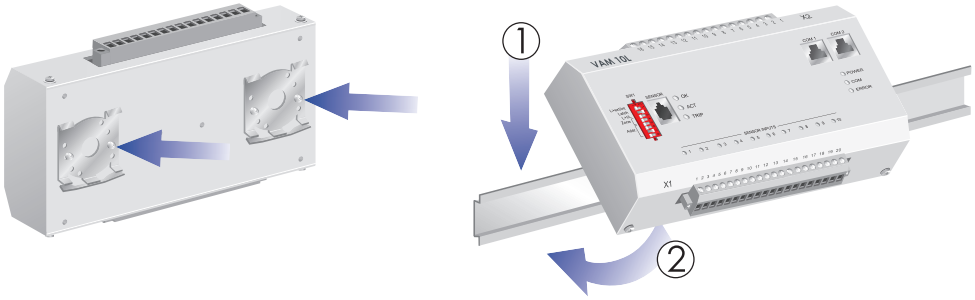
9.1 Dimensional drawings

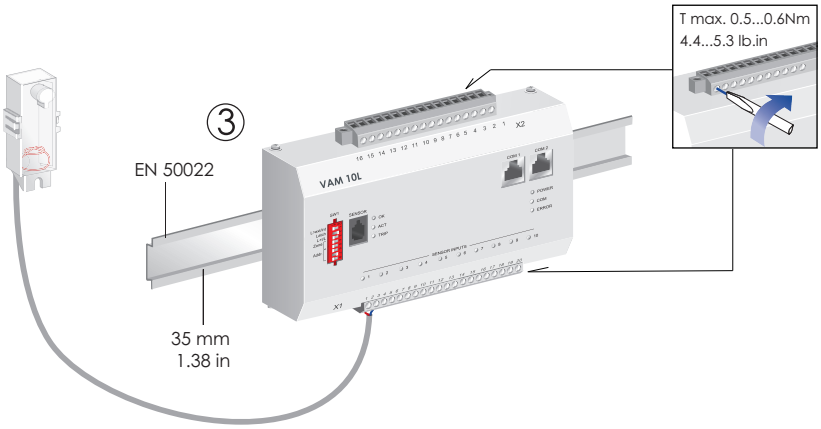
9.1.1 VAM 3L / 3LX Din rail mounting



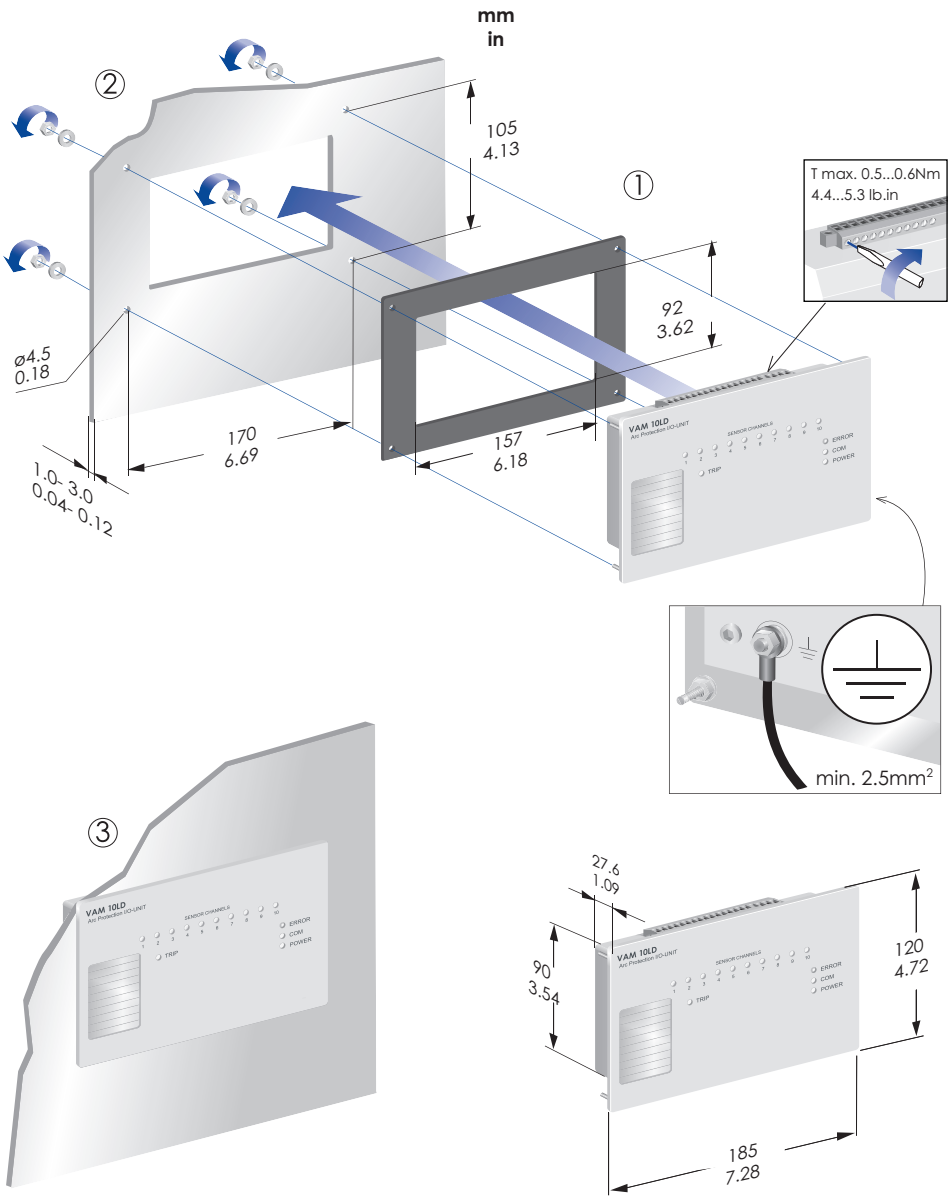
9.1.2 VAM 10L Din rail mounting



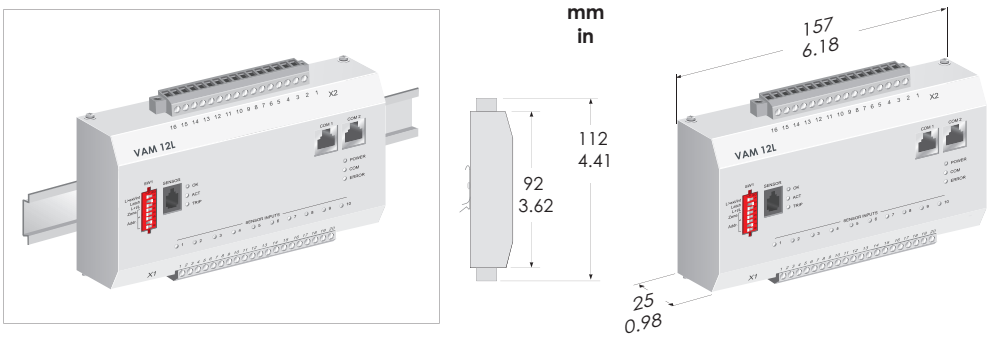


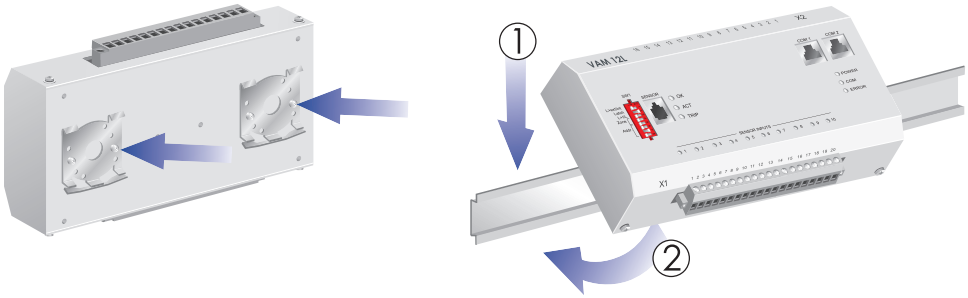


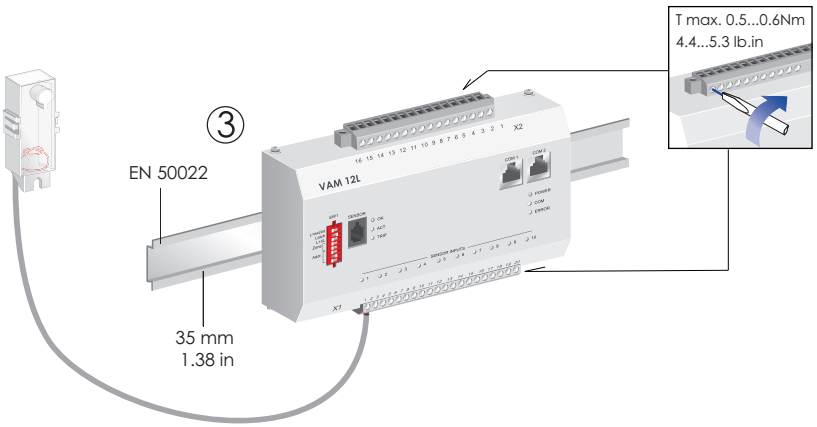
9.1.3 VAM 10LD Flush mounting



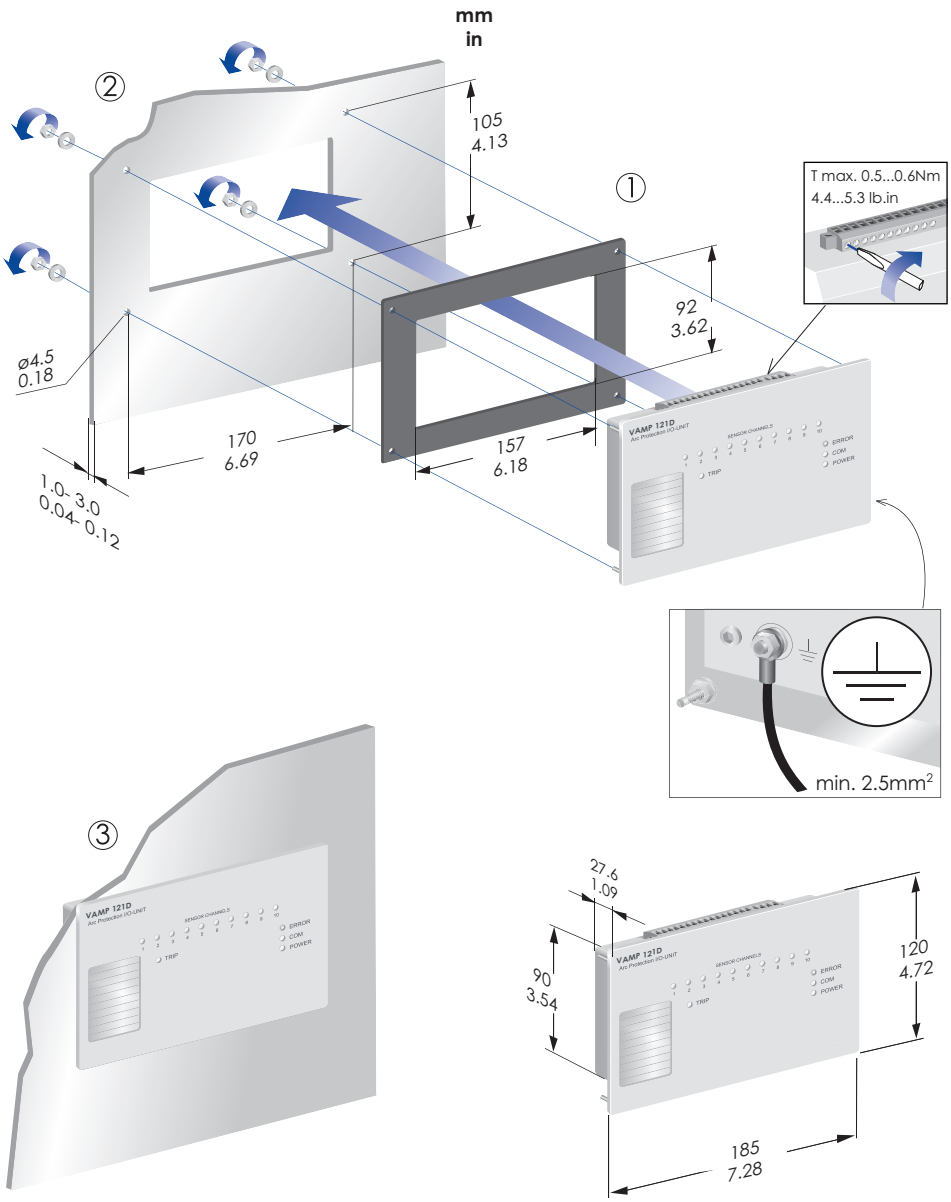
9.1.4 VAM 12L Din rail mounting



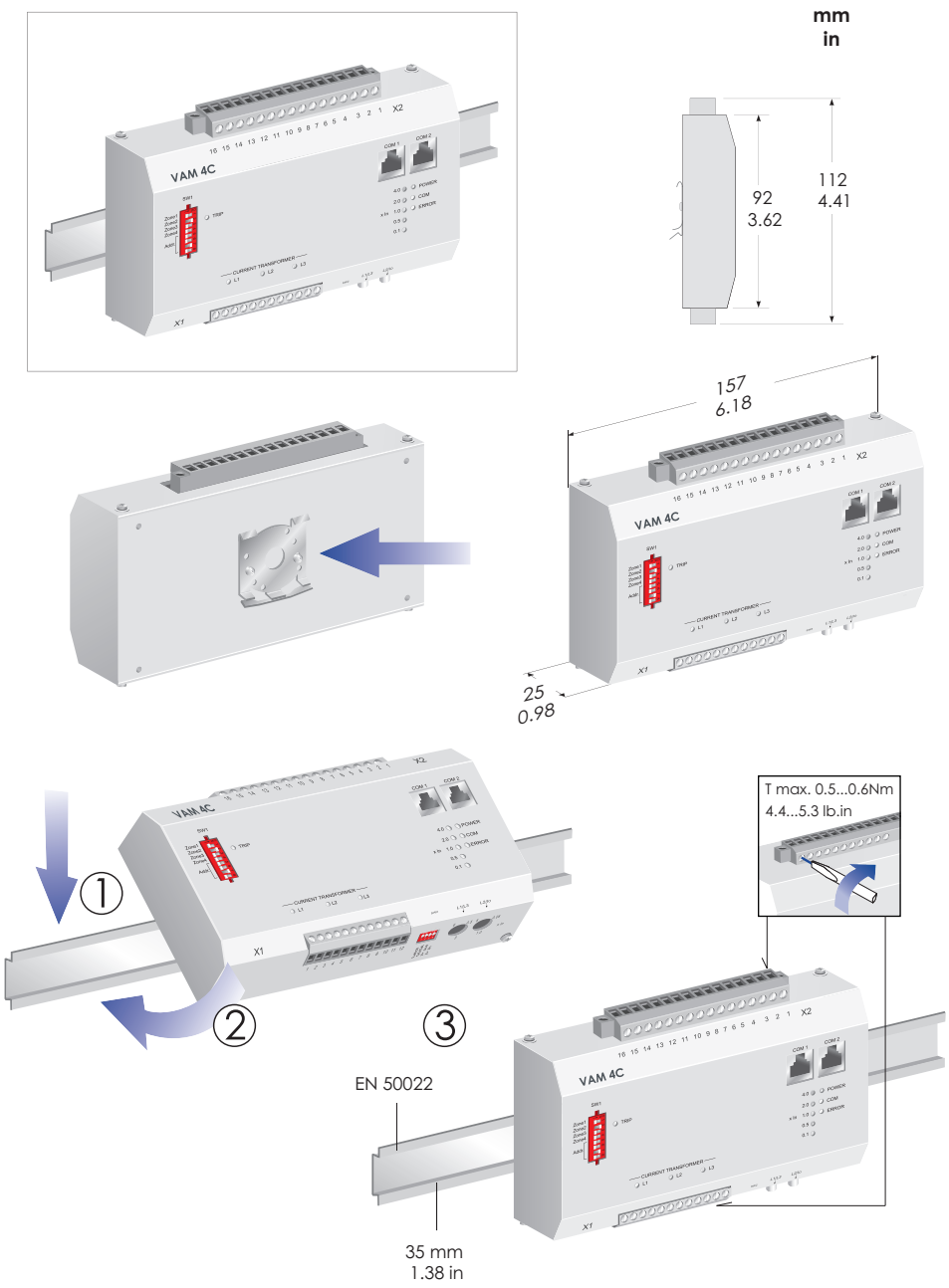




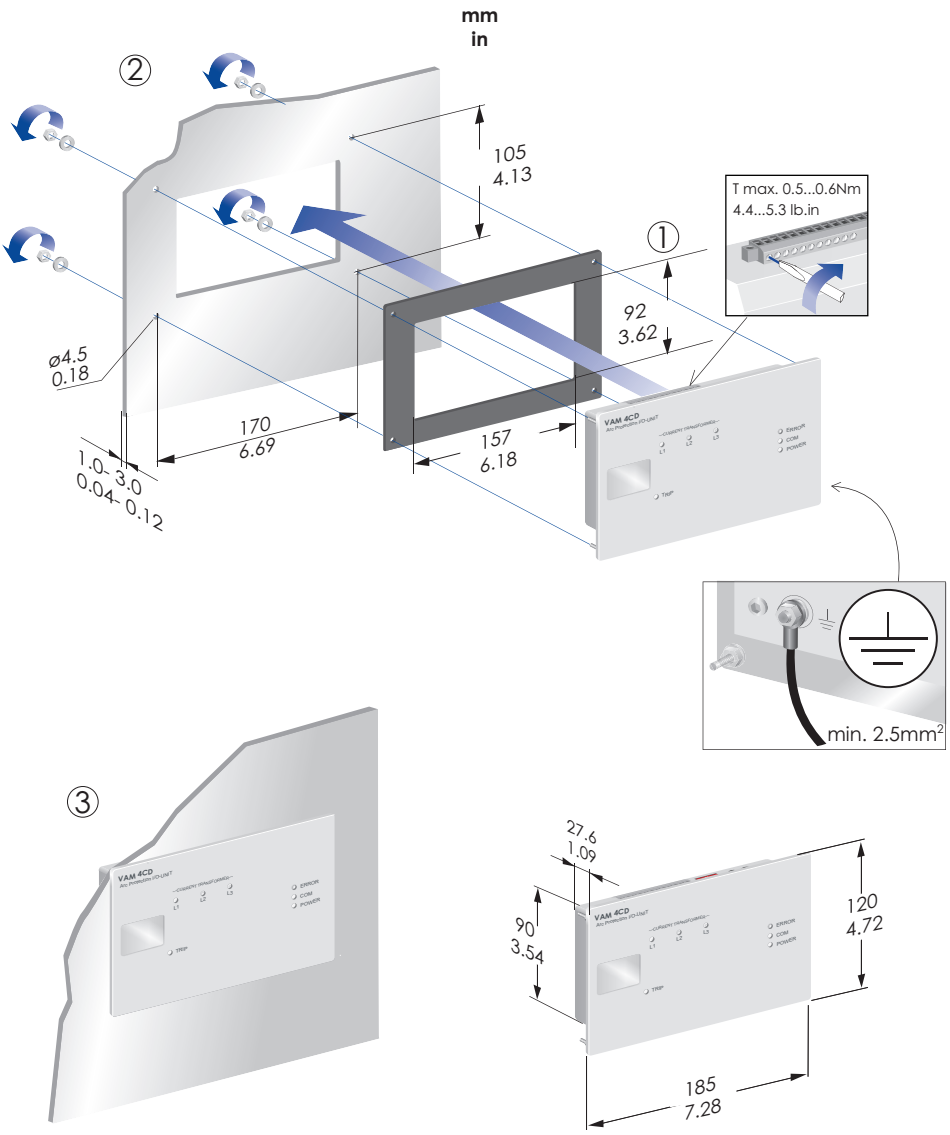
9.1.5 VAM 12LD Flush mounting



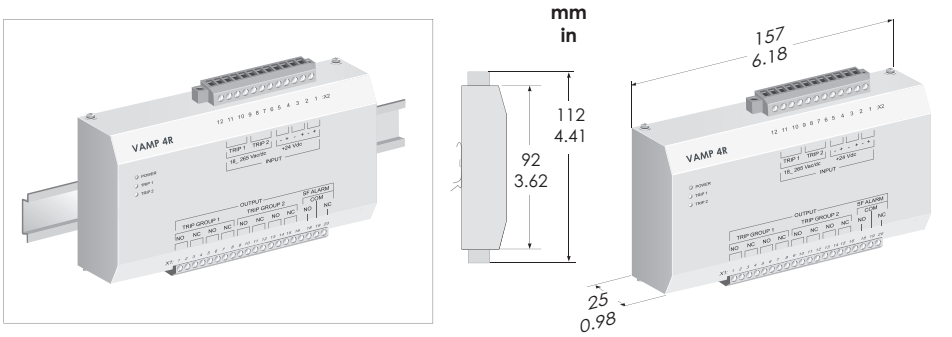
9.1.6 VAM 4C Din rail mounting

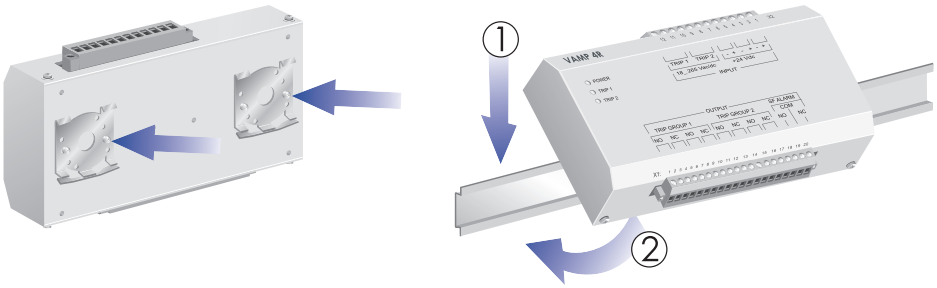


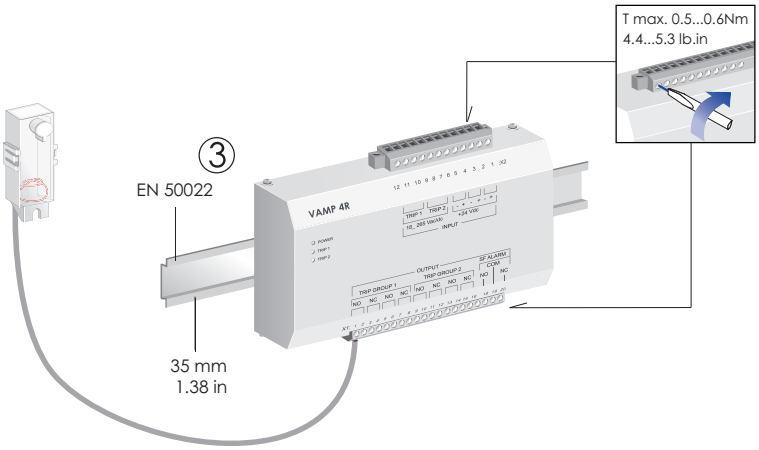
9.1.7 VAM 4CD Flush mounting



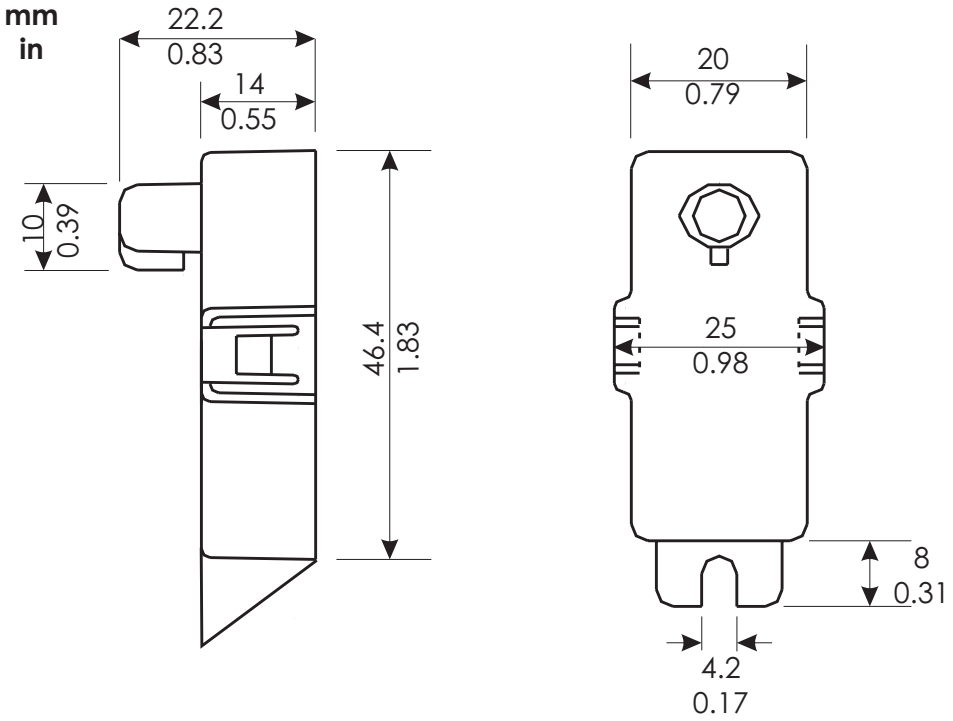
9.1.8 VAMP 4R Din rail mounting





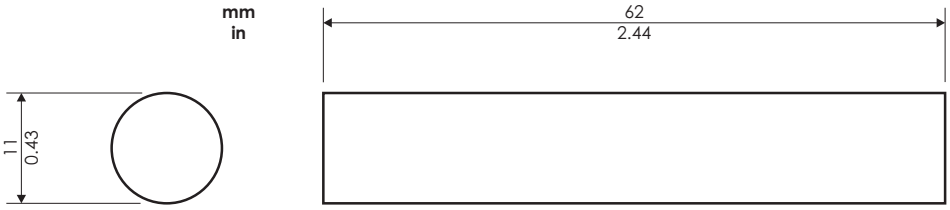


9.1.9 VA 1 DA



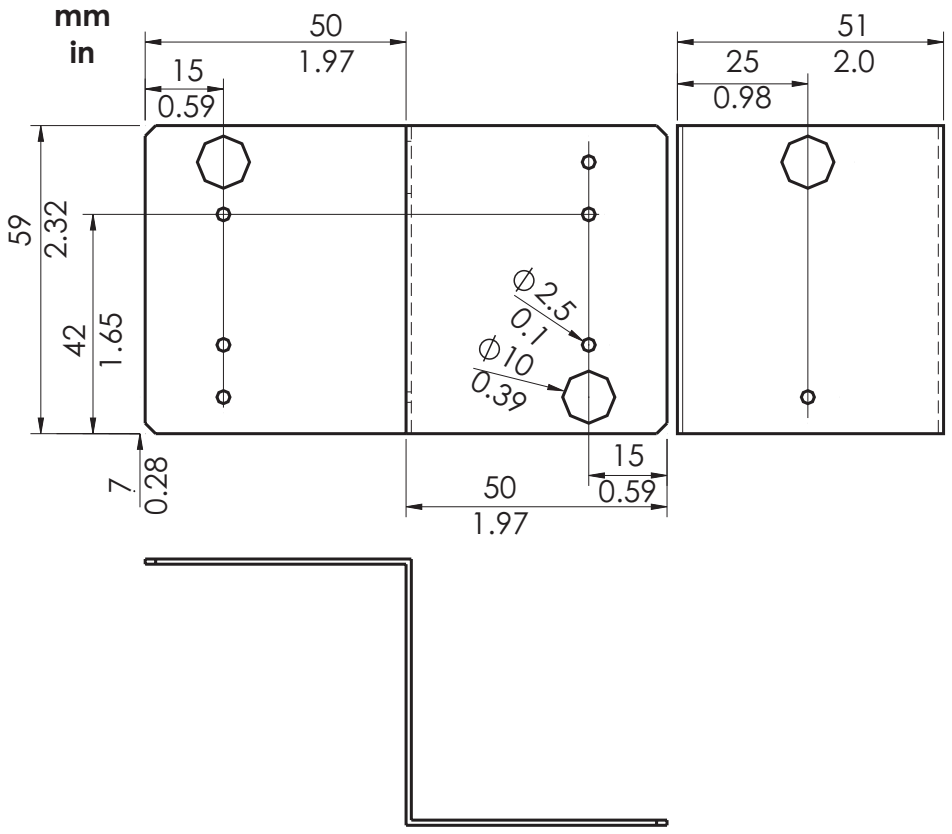
VA1DA_mittakuva

9.1.10 VA 1 EH



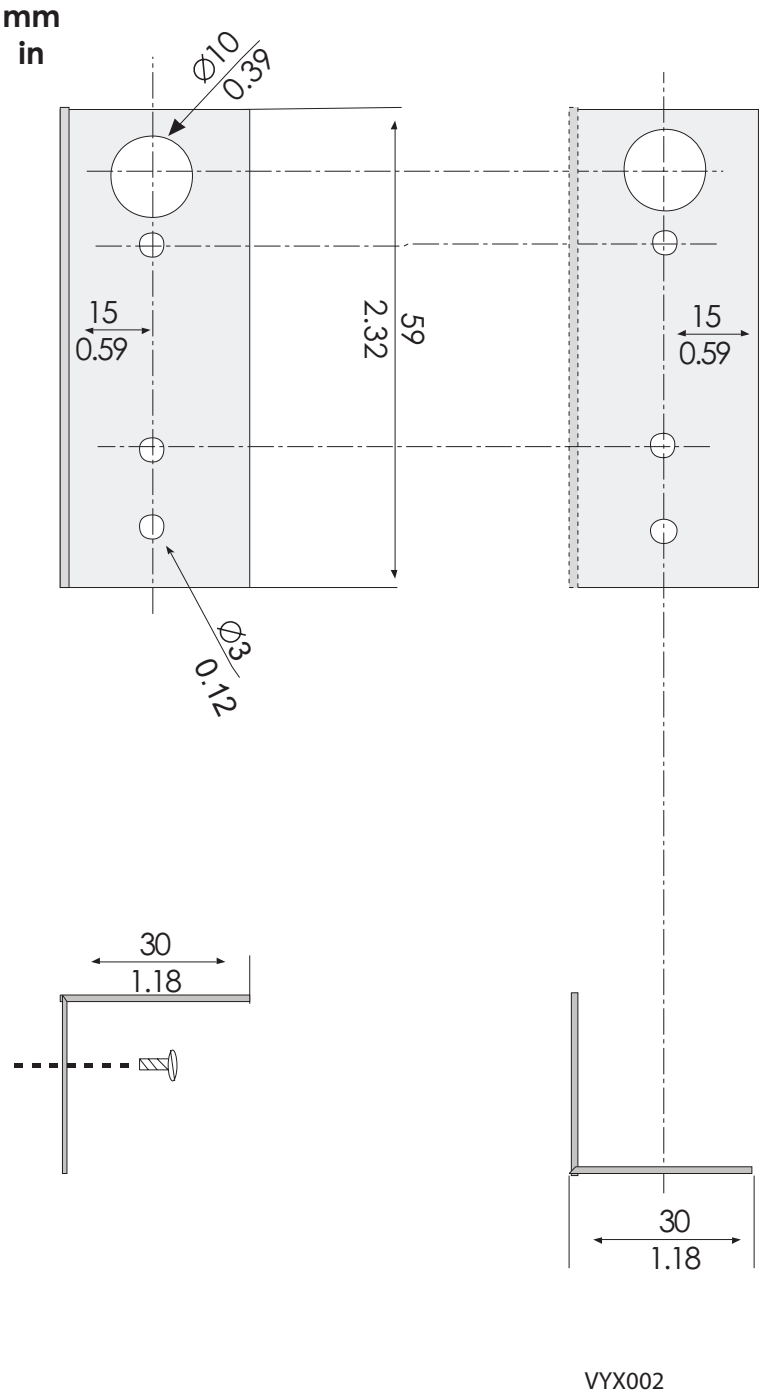
VA1EH_mittakuva

9.1.11 VYX 001



VYX001_mittakuva

9.1.12 VYX 002



VYX002

9.2 I/O unit mounting and wiring

⚠CAUTION Read this User's Manual carefully before undertaking any installation or wiring work.

Safety instructions

Always observe the national electrical safety regulations when working under live conditions. The unit manufacturer is not liable for damage due to incorrect working methods or failure to observe safety instructions.

The correct handling of the unit under all mounting and operating conditions forms the foundation for its safe use.

⚠CAUTION Any separately marked notes and warnings must be observed.

The wiring work must be performed according to national standards and any requirements specified by the customer.

Do not connect the auxiliary supply voltage until the installation has been completed.

Before installation

Before installation, make sure the environmental conditions comply with the requirements specified in Chapter 7.

⚠CAUTION The unit contains components liable to damage if exposed to an electrostatic discharge (ESD). Do not open the unit unless you have taken appropriate protective measures against ESD.

The manufacturer cannot guarantee operational safety in environments that do not satisfy the specified environmental conditions.

9.2.1 VAM 3L, VAMP 3LX, VAM 10L, VAM 12L, VAM 4C

The units are designed for mounting on a DIN rail. Mount the units on the rail in such a way that the indicator lights on the front panel are visible and the sensor wiring can be made as easily as possible.

9.2.2 VAM 10LD, VAM 12LD, VAM 4CD

The units are designed for mounting on a door. Hence all indicators are clearly visible in normal operation.

9.3 Wiring of the I/O units

The I/O units can be connected to the following:

- secondary circuits of the current transformers of the switchgear (VAM 4C only)
- the trip circuits of the circuit breakers
- external auxiliary supply circuits
- connections to the central unit or other I/O units (data communication and auxiliary supply)
- connections to other central units or protection relays (DI or DO bus)

9.4 Wiring the secondary circuits of the current transformers (VAM 4C / VAM 4CD only)

Connect the secondary circuits of the current transformers to the following screw connectors:

- X1-1, X1-3 (L1)
- X1-5, X1-7 (L2/I0)
- X1-9, X1-11 (L3)

The arc protection system can also be single or two-phase connected. Three-phase connection is nevertheless recommended for optimal operating speed.

NOTICE

The current measuring channels L1 and L3 must be used in connection with two-phase current measuring. Single-phase current or earth-fault current must always be connected to the current measuring channel L2/I0; otherwise, an unbalance error will occur.

The specified operating time of 7ms can only be guaranteed for three-phase current measurement.

9.5 Wiring the trip circuits of the circuit breakers

Connect the circuit breaker's trip circuit to the following terminals:

TRIP1: X2-15, X2-16 (fast)

In the event of an arc fault, the output contact will close at 7 ms when three-phase current measurement is used.

The output trip relay of the light I/O units (VAM 10L and VAM 3 L) operates during faults in its own zone. In the current I/O unit (VAM 4 C), select the protection zone controlling the I/O unit using the programming switches.

If several trips are required, the multiplying relay VAMP 4R can be used.

9.6 Wiring between the central unit and the I/O unit

Connect the central unit to the I/O units with a modular cable of type VX001. The modular cable carries all information between the central unit and I/O units, including data in serial form, arc fault messages and operating supply to the I/O units.

- Connect the VX001 cable to the arc I/O COM interface of the central units.
- Connect the cable to COM1 or COM2 on the first I/O unit.
- Route the cable from COM1 or COM2 on the first I/O unit to COM1 or COM2 in the next unit, etc.

All the COM1 and COM2 interfaces are identical, i.e. the cable can always be connected to either interface. The maximum total length of the modular cable, taking into account all the I/O units connected to the central unit, is 100 m.

⚠CAUTION Use only star connection for I/O units. Closed loop will cause communication errors.

9.7 Wiring separate auxiliary supplies

When routing modular cables over long distances or when the system contains several I/O units, you should preferably use a separate auxiliary supply parallel with the modular cable.

Connect the auxiliary supply to the 24 V terminals of the central unit to the 24 V terminals in the I/O units. Alternatively, you can also use a separate external voltage supply 3P004.

NOTICE Pay particular attention to the polarity of the cable connections.

9.8 VAMP 4R

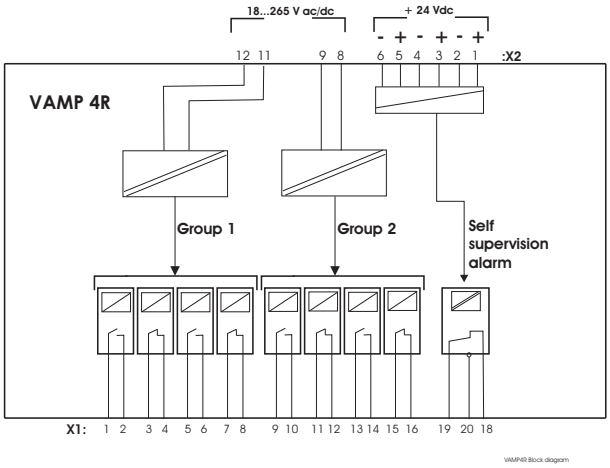


Figure 9.1: VAMP 4R block diagram

The multiplying relay VAMP 4R can be used when additional trip outputs are needed.

VAMP 4R comprises 4 N/O contacts and 4 N/C contacts. They are divided into two separate groups which can be independently controlled by e.g. the binary output of the I/O units or the central unit.

- Attach the VAMP 4R unit to a DIN rail.
- Connect the auxiliary voltage (+24V) to terminal X2-1 (+) and X2-2 (-). Terminals X2-3 and X2-5 are parallel inputs to X2-1(+). Terminals X2-4 and X2-6 are parallel inputs to X2-2(1). The auxiliary voltage (+24V) can be supplied from the central unit or nearest slave (X2-1 (+), X2-2 (-)).
- Connect the required signal (18-265 V ad/dc) to the trip control inputs.
- Input “TRIP 1” (X2-11, X2-12) is controlling the trip group 1. Input “TRIP 2” (X2-8, X2-9) is controlling the trip group 2.
- There are 2xN/C + 2xN/O contacts per trip group.

If necessary, input TRIP 1 and 2 can be connected in parallel. Then all trip relays will operate simultaneously.

9.9 Wiring multiple central units

A maximum of three central units can be connected to one communication bus. In this case, the units can operate on a maximum of four protection zones (depending on their programming switches). The light and current signals given by the I/O units, including address information, are transferred to each central unit.

If more than one central unit is to be connected to the same communication bus, one central unit must be in central unit mode and the other central units in sub-unit mode.

In applications with multiple central units the central units can be interconnected also via BI/O connections (binary input/output). In this case, each part of the system can control four protection zones per system communication bus. In this case, arc and overcurrent information is transferred between the central units without address information.

NOTICE

When configurating arc protection system with multiple central units, disconnect I/O-units from central units in slave mode during their installation procedure.

9.10 Arc sensors

Mount the sensors on the switchgear in such a way that they cover the protection zone as completely as possible. The line of sight must be free between the sensor and the supervised area.

If point sensors are used in open compartments (such as bus-bar sections), there should be a sensor approximately every 5 meters. Due to the wide detection range of the sensors and the light reflection inside the switchgear, the mounting position is not critical.

Connecting sensors VA 1 DA and VA 1 EH to the I/O units

The sensors are delivered with 6-metre standard cables or 20-metre shielded cables (to be specified in the order).

After mounting the sensors, connect them to the I/O units as follows:

- Draw the wire to the nearest I/O unit using the shortest route possible and cut it to a suitable length.
- Connect the arc sensors to the screw terminals X1-1…20. The polarity of the arc sensor cables is not critical.

Connecting the ARC-SLx sensors to the I/O units

The sensors are delivered in standard lengths (to be specified in the order) equipped with terminals compatible with VAM 3L units.

After mounting the sensors, connect them to the I/O units as follows:

- Draw each end of the sensor to the I/O unit and carefully form a loop of the extra fibre.

NOTICE Do not shorten the extra sensor fibre unless you have appropriate terminal connectors.

- Connect the arc sensors to plug-in terminals X1-R1, T1…R3, T3. While the polarity of the arc sensors is not critical, you must connect each end of the fibre to the same channels.

VA 1 DA

You can be install the arc sensor onto the switchgear wall from the outside. Press the active part of the sensor through the 10-mm hole in the wall and fix it using a 4-mm screw.

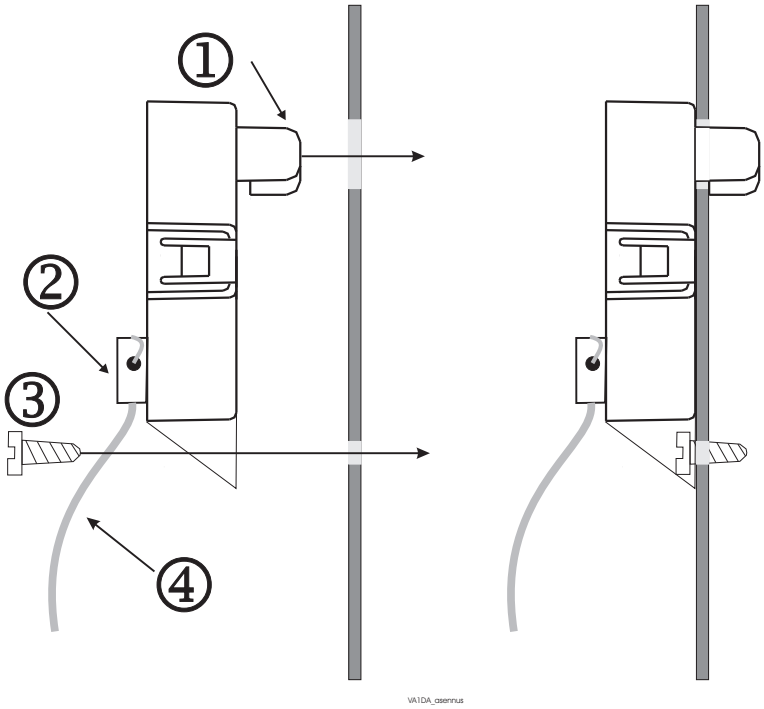


Figure 9.2: Mounting the arc sensor VA 1 DA

1. Active part of the sensor
2. Cable clamp
3. Fastening screw 4x15 mm
4. Cable of sensor

You can also surface mount the sensor to the wall using the mounting plates VYX01 or VYX02, available as additional parts.

NOTICE The sensor must not be exposed to direct sunlight or other strong light. Do not mount the sensor directly under a light source.

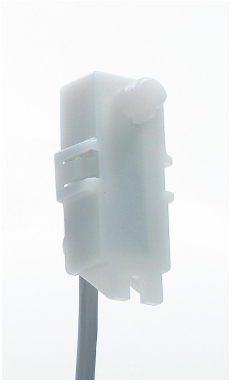


Figure 9.3: Arc sensor VA 1 DA

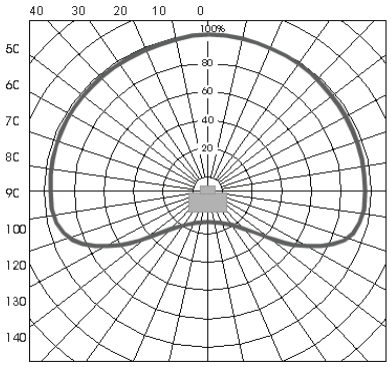


Figure 9.4: Sensitivity of the arc sensor VA 1 DA

VA 1 EH

You can be install the arc sensor onto the switchgear wall from the outside. Press the active part of the sensor through the 10.5-mm hole in the wall.

You can also surface mount the sensor. To do this, push the sensor into a plastic mounting tube and fix it with heat shrink tubing.

NOTICE

The sensor must not be exposed to direct sunlight or other strong light. Do not mount the sensor directly under a light source.

Figure 9.5: Arc sensor VA 1 EH

ARC-SLx

ARC-SLx is an fibre sensor that can be mounted on the switchgear to monitor several compartments simultaneously (various bus-bar compartmets, etc.).

The fibre must not touch any live parts of the switchgear or other hot components, since too high temperatures may destroy the fibre.

When mounting the sensor on the switchgear, ensure that the bending radius is long enough (min. 80 mm) and that it is safe from the sharp edges of the switchgear.

NOTICE

The sensor must not be exposed to direct sunlight or other strong light. Do not mount the sensor directly under a light source.

To avoid false tripping, cover any unused channels of the I/O unit.

Figure 9.6: ARC-SLx

VA 1 DP

The portable pin sensor can be temporarily connected to the I/O units. It is used to improve safety when working with live switchgear, for example, Attach the sensor close to the working area, for example in the breast pocket of the maintenance man.

A pin sensor operates in the same way as a fixed arc sensor. The only difference is free mobility within the limits of the connecting cable.

Figure 9.7: Pin sensor VA 1 DP

NOTICE

To avoid faulty tripping, disconnect the pin sensor from the system immediately after use.

10 Order information

Order code	Explanation	Note
VAM 3LSE	Fiber sensor I/O unit (VAMP221)	3 fiber loops, 1 trip relay
VAM3LXSE	Fiber sensor I/O unit (VAMP221)	3 fiber loops, 1 trip relay, adjustable sensitivity
VAM4CSE	Current I/O unit (VAMP221)	3 current inputs, 1 trip relay
VAM4CDSE	Current I/O unit (VAMP221)	3 current inputs, 1 trip relay, flush mounting
VAM10LSE	Point sensor I/O unit (VAMP221)	10 sensor inputs, 1 trip relay
VAM10LDSE	Point sensor I/O unit (VAMP221)	10 sensor inputs, 1 trip relay, flush mounting
VAM12LSE	Point sensor I/O unit (VAMP221)	10 sensor inputs, 3 trip relays
VAM12LDSE	Point sensor I/O unit (VAMP221)	10 sensor inputs, 3 trip relays, flush mounting
VAMP4RSE	Trip multiplier relay	4 x NO, 4 x NC, 2 groups
VA 1 DA-6	Arc Sensor	Cable length 6m
VA 1 DA-20	Arc Sensor	Cable length 20m
VA 1 DT-6	Temperature sensor	Cable length 6m
VA 1 DP-5	Portable arc sensor	Cable length 5m
VA 1 DP-5D	Portable arc sensor	Cable length 5m
VA 1 EH-6	Arc sensor (pipe type)	Cable length 6m
VA 1 EH-20	Arc sensor (pipe type)	Cable length 20m
ARC SLm-x	Fiber sensor, 8000 lx	x= fiber length (2
VX001-xx	Modular cable VAM <-> VAM (xx= cable length [m]	Preferred cable lengths (3
VX031-5	Extension cable for VA1 DP-5D	Cable length 5m
VX052-3	USB programming cable (VAMPSET)	Cable length 3m
VX054-3	Interface cable to VPA 3CG (Profibus module) for RS-232	Cable length 3m
VYX001	Surface mounting plate for sensors	Z-shaped
VYX002	Surface mounting plate for sensors	L-shaped
VSE001PP	Fiber optic interface module (plastic - plastic)	RS-232 mode only
VSE002	RS485 interface module	RS-232 mode only
VPA3CG	Profibus interface module	

Note 2: Fiber lengths 1 , 5, 10, 15, 20, 25, 30, 35, 40, 50 or 70 m

Note 3: Cable lengths 1, 3, 5, 7, 10, 15, 20, 25 & 30 m

11 Glossary

Term	Description
BI	Binary input
BO	Binary output
Document file	Stores information about the IED settings, events and fault logs.
FPGA	Field-programmable gate array
HMI	Human-machine interface
IED	Intelligent electronic device
LCD	Liquid crystal display
LED	Light-emitting diode
Local HMI	IED front panel with display and push-buttons
PC	Personal computer
VAMPSET	Configuration tool for VAMP protection devices

Customer Care Centre

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